UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

PROJECT MANAGEMENT PLAN DEVELOPMENT FOR SUPPLY AND INSTALL OF GENERATOR AND MECHANICAL & ELECTRICAL UPGRADE FOR BELIZE WATER SERVICES LIMITED

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FINAL GRADUATION PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
MASTER'S IN PROJECT MANAGEMENT (MPM) DEGREE

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APPROVAL

This Final Graduation Project was approved by the University as partial fulfillment of the requirements to opt for the Master in Project Management (MPM) Degree

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DEDICATION

This study is dedicated to my family. First and foremost, those members of my family who prayed for my success and accomplishments but are no longer living to see me achieve them, Aunt Lynda and my grandmother Rose. Also, to my mother who has made countless sacrifices to see me further my education. To my two aunts, Koreen and Gilda, for the constant encouragement, support and their constant prayers.

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I would like to thank my family for being supportive for the past year and half while I completed my Master's degree. My thanks and appreciation for the concern and constant support shown by my family. I am grateful to have had encouragement and the uplifting words of my family.

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ABBREVIATIONS AND ACRONYMS

BEL	Belize Electricity Limited
BoQ	Bill of Quotation
BTL	Belize Telemedia Limited
BWS	Belize Water Services
BZD	Belize Dollars
CEO	Chief Executive Officer
CFO	Chief Finance Officer
CPI	Cost Performance Index
EVM	Earned Value Management
FGP	Final Graduation Project
GOB	Government of Belize
MCC	Motor Control Center
MS	Microsoft
ORG.	Organization
PMI	Project Management Institute
PMO	Project Management Office
PMBOK	Project Management Body of Knowledge
PUC	Public Utilities Commission
PxI	Probability/Index
RBS	Risk Breakdown Structure
RFQ	Request for Quotation
TSD	Technical Service Department
TSM	Technical Service Manager
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

The Belize Water Services is the national water and sewage service provider in the country of Belize. BWS provides services to all municipalities, villages and major island towns in Belize. BWS developed a five-year plan which was intended to impact capital expenditure through initiatives such as providing cost efficient and reliable water and wastewater services. The Company has undertaken projects in the following areas to accomplish its five-year plan: water network expansions projects, upgrade or replace aged infrastructure projects, refurbishment and expansion of water treatment plants and storage tanks as well as construction of new water sources. BWS had been carrying out the objectives set out in the Business Review Plan 2015-2020 and by doing so the company has had an increase in project work being executed throughout the country; in May of 2018 the total operational list of projects was estimated to be 106 active projects.

BWS has yet to implement the five Process Groups and the ten Knowledge Areas in accordance with Project Management Institute. The engineers who have executed the projects have done so with the usage of Project Management Information Software tools such as Microsoft Office Project and utilized Project Management Knowledge Areas vaguely. This created many instances of lapses in project work which have resulted in shortcomings such as work that had to be redone and most commonly were projects not meeting its constraint of time, scope and budget.

The Purpose of the Final Graduation Project is to create a Project Management Plan which can be used to by BWS to execute the project the Supply and Install of Generator and Mechanical and Electrical Upgrade Project. This management plan will provide the BWS with the required action plans to successfully complete the project and achieve the Project objectives of supplying its customers with uninterrupted supply of electricity to pumps to ensure the continuous supply of water; particularly in times of power outages and electrical faults.

The Main Objective is to create a Project Management Plan that will be used by the Engineers and project staff assigned to execute the Supply and Install of Generator and Mechanical and Electrical Upgrade of the Benque standby facility. The Specific Objectives of this plan are as following: To Create a Scope Management Plan to ensure that the project included all the work required to complete the project; To Create a Schedule Management Plan to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project schedule; To Create a Cost Management Plan to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project cost; To Create a Quality Management Plan to manage the identified quality requirements for the project; To Create a Resource Management Plan to manage the defined resources that were required to complete the project; To Create a Communication Management Plan to develop the appropriate

approach and plan for the project communications based on stakeholder information needs and requirements and available organizational assets; To Create Risk Management Plan to develop options and actions enhancing opportunities and reducing threats to the project objectives; To Create a Procurement Management Plan to document project procurement decisions, specifying the approach and identifying potential sellers; To Create a Stakeholder Management Plan to identify the people or groups or organizations that impact or may be impacted by a decision, activity, involvement, influence and potential impact on project success.

The Methodologies that were used where appropriate were analytical, quantitative and qualitative methods. Some of the sources that were used during this study were Interview with head Engineer, budget provided by Company, 2017 Annual Report, Company Web Site and PMBOK Guide 6th Edition. Much of BWS organizational assists were used, information form past projects was a crucial part of the project inputs in many of the Management Plans.

The results of the Final Graduation Project were presented in the completion of the various management plans. The Scope Management Plan which outlined the WBS, Acceptance Criteria and project constraints, inclusions and exclusions; Schedule Management Plan which define activity list and schedule tools, Quality Management Plan specified how quality would be defined and tested; Resource Management Plan define team development activities and resource acquisition methods; Communication Management Plan outline communication requirements and strategies as well as templates and samples; Risk Management Plan defines risk analysis techniques and template for RBS and risk monitoring; Procurement Management Plan and Stakeholder Management Plan resulted in the development of stakeholder discovery strategies and templates for displaying data. The Plans addressed the specific elements that were required to effectively execute the project, elements such as information identification, planning methods, management and control tools and techniques.

It is highly recommended that BWS makes an investment in developing a Project Management Office which would oversee all project activity. The company would see great benefit from implementing a project management education program for all employees who are tasked with carrying out the project work of the company.

1. INTRODUCTION

1.1 Background

Belize Water Services Limited (BWS) is the only national water and sewage utility company in Belize. According to BWS (2017) they provide service to all nine municipalities and 35 villages throughout the country. That equates to 57,200 customer and approximately 250,000 consumers and an average monthly water consumption of 208 US Gallons. BWS uses traditional water treatment processes to treat water from rivers and satellite wells. In addition, reverse osmosis is used to treat seawater for consumers living on the Islands of San Pedro and Caye Caulker.

In BWS' yearly Report to Shareholders published in 2017 for the financial year of 2016 to 2017, the company addressed its current state and desired outlook "Since inception, BWS has continuously invested in the improvement of assets and implementation of improved procedures and controls to increase its efficiency. In performing all the various investment projects, most of which are expansions or improvements to the water systems, BWS focuses on the requirements of our stakeholders, primarily our Customers, Employees and Stakeholders. Fundamental to meeting the company's vision, both in the short and long term, has been the initiation of a holistic strategic approach towards improving the Company's performance. This broad-based strategy, utilizing a structured approach to balance and align initiatives, provides the Company with a firm platform, which builds on achievements and aims to achieve further objectives in the coming years."

In 2015, BWS published a Business Plan Review Report 2015 - 2020 which presented the current situation of the company and laid out future plans by way of justifications for a 12% Tariff increase that was awarded to BWS in 2010. The company planned to focus on "investment needs of population growth, handle emergency/disaster situations, provide fair return to shareholders and ensure the overall viability of BWS." (BWS, 2010).

To achieve all that has been set out in the Company's five-year plan and to achieve the company's goals and visions, BWS is currently in a state of development. Works are being carried out every day to reach the targets. Currently BWS has a

portfolio of 106 projects, the company has been successful in completing projects. This Project is of key importance to be completed and needs to be completed without mishap because it is key to the company addressing disaster situations and emergency.

1.2 Statement of Problem

BWS is endeavouring a project to supply and install a new generator and upgrade the mechanical and electrical componenets of one of its standby facility in western Belize. The main problem is that the Engineer Team entrusted to manage this project does not have in place a complete Project Management Plan to execute the project. This resulted in delayed projects, high occurrence of rework and inefficent spending due to poor and inconsistent project planning. The Project Management tools being used by the Engineer and team are insufficient and lacking, leaving the execution of the project open to greater risk of failure and inconsistency. Currently the Project Team has drafted the project in the Microsoft Project Software; however, they have failed to incoporate these tools in sequence and procedure which align with the five Process Groups and the ten Knowledge Areas in accordance with PMI.

1.3 Purpose

The purpose of this document is to develop Project Management Plan for the Supply and Installment of Generator and Mechanical and Electrical Upgrade Project being conducted by BWS. The goal is to create a Project Management Plan that can be used by the Engineer and Project Team of this project to bring together and develop the project management practices that are currently being used by the Team. This Project Management Plan will seek to eliminate or minimize the general complaints that are given when projects do not meet schedule, budget and unfulfilled scope, to name a few of the common problems encountered.

This Project Management Plan that will be developed is the first stage to step in demonstrating to BWS Management the benefits and value of incorporating Project Management methodology in its entirety to the company's Operations Department which is responsible for carrying out all technical projects.

1.4 General objectives

To Develop a Project Management Plan that will be used BWS to supply and install a he generator and upgrade the mechanical and electrical components of the Benque Viejo Del Carmen standby facility.

1.5 Specific objectives

- To Create a Scope Management Plan to ensure that the project included all the work required to complete the project;
- To Create a Schedule Management Plan to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project schedule;
- To Create a Cost Management Plan to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project cost;
- To Create a Quality Management Plan to manage the identified quality requirements for the project;
- To Create a Resource Management Plan to manage the defined resources that were required to complete the project;
- To Create a Communication Management Plan to develop the appropriate approach and plan for the project communications based on stakeholder information needs and requirements and available organizational assets;
- To Create Risk Management Plan to develop options and actions enhancing opportunities and reducing threats to the project objectives;
- To Create a Procurement Management Plan to document project procurement decisions, specifying the approach and identifying potential sellers;

- To Create a Stakeholder Management Plan to identify the people or groups or organizations that impact or may be impacted by a decision, activity, involvement, influence and potential impact on project success

2. THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

Company/Enterprise background

The Belize Water Services Limited (BWS) is the national water and sewer service provider in Belize. BWS was established in 2001 as a part of the Government of Belize privatization initiative, the company was endowed with the assets and liabilities of the former Water and Sewage Authority (BWS, 2014). In the company's history, BWS has undergone the transformation from "Statutory Body to a private company owned by a transnational water company (2001), and then to majority Government ownership (October 2005).", (BWS, 2014).

Since its inception BWS has focused on three main areas, improving efficiency of the products and services they provide to control costs, expanding services to widen accessibility of services as well as satisfying the expectations of the 57,200 customers.

Over the years BWS has been involved in infrastructure upgrade projects due to an increase in national and municipal road and street infrastructure development throughout the country of Belize. BWS and the government have collaborated on most of these national government and municipal projects to allow BWS to complete upgrades to existing infrastructure. The company has also used events such as natural disasters like hurricanes, storms and floods to highlight weaknesses and make improvements in areas such as response and recovery during and after these events. BWS has been successful in maintaining and improving the Key Performance Indicators in areas such as "Water Coverage, Staff Efficiency, Collection Efficiency, Working Ratio and Profitability" (BWS, 2014).

Mission and vision statements

"Proving Excellence and Continuity in Every Drop" is the slogan that BWS used in the company's 2017 annual progress report, this slogan is reflective of the themes of the Mission and Vision set for by the company. In addition to the Mission and Vision, the company also set forth values. Values are used to support the Vision of

BWS. The Values listed are Fairness, Accountability, Integrity, Respect, Stewardship, Service-oriented and Teamwork.

Mission Statement:

“To improve the lives of consumers by delivering quality and cost-effective water and water services in an environmentally responsible manner while promoting employee excellence, fulfilling our social responsibility and providing a fair return to our stakeholders”

Vision Statement:

“By 2018 we will be the leading provider of water and water services in the region and will exceed out stakeholders’ expectations.”

Organizational Structure

Belize Water Services Limited is structured in a hierarchical or top level organizational structure. The company is comprised of ten Board Members who make up the Board of Directors. The board acts on behalf of the shareholders and is tasked with making strategic business decisions that ensure the company’s prosperity. Beneath the Board of Directors there is the Management Team which is led by the CEO, the department managers are followed by the employees. BWS’ Business Plan Review (2014) goes on to give further insight into the structure of the company stating that “Below each departmental manager are varying levels of junior managers, technician supervisors, foremen or senior clerks, and line workers or clerks. The current total full-time staff complement is 257.”

The organizational structure of BWS is depicted in the figure below, the numbers in parentheses represent the number of persons in each respective department.

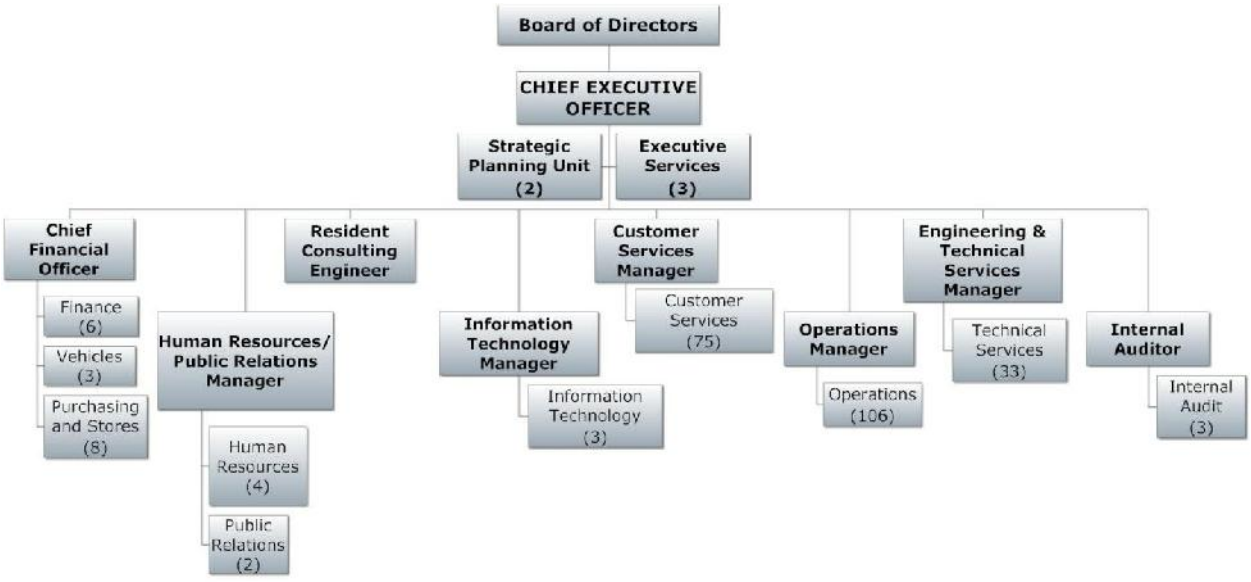

Figure 1 BWS Organizational Structure

Source: (BWS, 2014)

Products Offered

BWS is the national water and water Service Company in Belize. Being the sole water service company of the nation, the company provides a range of products and services that are critical to the quality of life of Belizeans.

BWS provides the following services to customers and consumers:

- Piped potable water (tap water) in all service areas
- Sewerage disposal and treatment in three service areas
- Quality Monitoring
- Other related services include connections, disconnections, leak checks, and leak and fault repair.

The illustration below shows the service areas covered by BWS in the country of Belize.

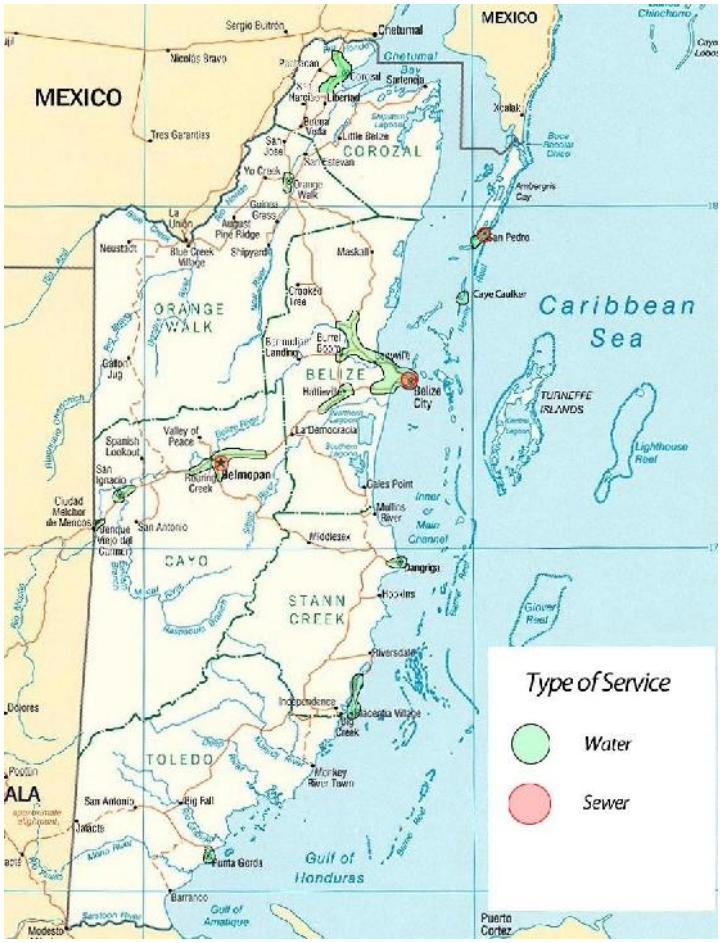

Figure 2 BWS Service Areas

Source: (BWS, 2014)

2.2 Project Management Framework

2.2.1 Project Management concepts

Project

The Project Management Book of Knowledge Guide 6th Editions defines a Project as a “temporary endeavour undertaken to create a unique product, service, or result” (PMI., 2017). Verzuh (2015) elaborates in his book that “every project has a beginning and an end. Fundamental to understanding the importance of projects is realizing that each one produces something unique.”. Definitions like the ones above give a distinct scope to the word *Project* as it relates to the world of Project Management. It defines boundaries and expectations such as *Temporary (there is*

*a start and end), Unique (*no two projects are the same) and *Product* (the objective of every project is to produce a result). Projects are plentiful and can be found across every industry but even though projects are vast they commonly measure success the same. The most frequently used success criteria of a project are time, budget and quality. Figure 3 highlights characteristics of a project as described in the literature on Project definition.

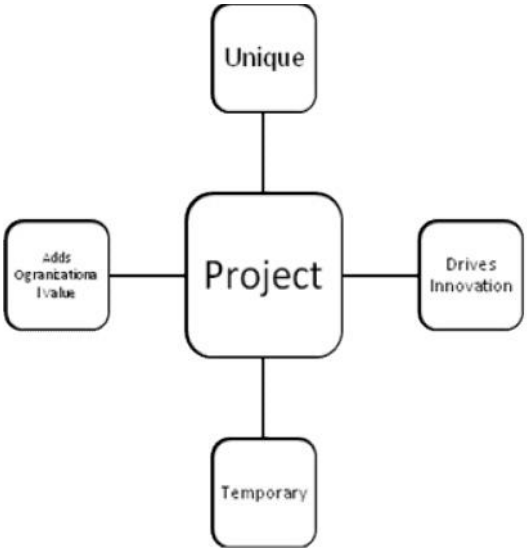

Figure 3 Elements of a project

Source: (author,2018)

Project management

Project Management is the use of incorporating knowledge, expertise and competence when conducting project work, with the intention of achieving success at the close of the project. According to PMI (2017) Project Management is “the application of knowledge, skills, tools and techniques to project activities to achieve project requirements.”, (PMI., 2017). Project Management has three main functions according to Verzuh (2015), these functions are as follows:

1. Project definitions
    a. Determine purpose, goals and constraints
    b. Establish controls such as roles of persons and organizations
    c. Communication strategy

    d. Change control processes
2. Project Planning
    a. Plan how project goals will be met given constraints
    b. Estimating and scheduling
    c. Risk strategy
3. Project Control
    a. Progress measurement
    b. Communication
    c. Corrective action

The processes of Project Management are iterative in nature and must be repeated, this is because plans require adjustments as new information becomes available.

In the development of the Final Graduation Project, these functions mentioned above will be applied. The FGP will include the definitions, planning and control; the compilation of these functions will produce the objective which is a Project Management Plan for the topic of choice. The Project Management skills and knowledge with shape the Project Management Plan developed as well as being instrumental in the student completing the FGP successfully.

Project life cycle

PMI (2017) define the Project Life Cycle as “the series of phases that a project passes through from it start to completion”, like PMI, Verzuh (2015) describes the Project Cycle as the progression of a project from the defining stages to the close. Both definitions have the common element of movement through the project phases in a progressive manner, from start to finish.

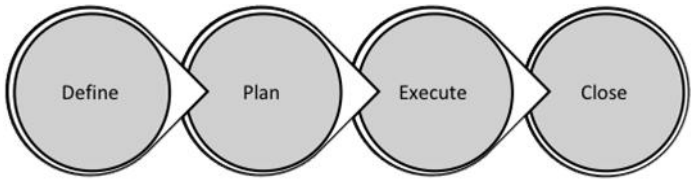

Figure 4 Standard Project Life cycle

Source: (Author,2018)

The PMI (2017), further explains the Project Life Cycle as being either sequential, iterative or overlapping in nature while completing project deliverables. During the development of the FGP the project will go through the phases outlined in the above figure, define, plan, execute and close.

Project Management Processes

A Project Management Process Groups is described by PMI (2017) as the grouping of project processes to achieve the project objectives. PMI (2017) outlines five processes which are used throughout the life of a project; these are Initiating, Planning, Executing, Monitoring and Controlling and Closing.

PMI (2017) breaks down the five process groups that are performed throughout the life cycle of each project and as follows:

1. Initiate – The processes required to gain approval to start a project or to get the green light to start a project.

2. Planning – The processes required to define scope, objectives and actions needed to achieve project objectives.

3. Executing – The processes performed to complete the work needed to achieve the project requirements.

4. Monitoring and Controlling - The processes performed to track and review the progress of the project and take corrective measure and apply change when needed.

5. Closing – The process performed to formally close a project.

Figure 5 demonstrates how these processes function in relation to each other.

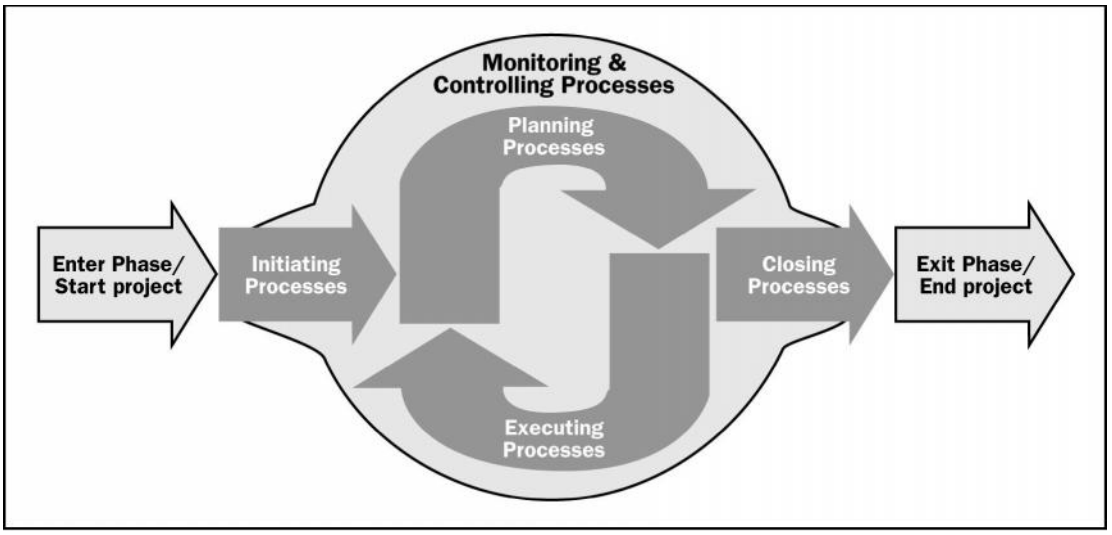

Figure 5 Process management group

Source: (PMI, 2017)

Project management knowledge areas

The Project Management Knowledge Areas are described by PMI (2017) to be “identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques.” The Knowledge Areas are performed separately; however, each area must go through each of the process groups mentioned in the section before. Each knowledge area relies on a specified group of inputs, tools and outputs that are unique to that area.

Many of the knowledge areas are not being addressed by the Company in relation to what is prescribed by the PMI. It is important the Project Management Plan development focuses on the following knowledge areas:

Figure 6 Project management Areas

Source: (PMI, 2017)

a) Project Scope Management – outlines the process to ensure the project includes only the work needed to complete the project.
b) Project Schedule Management – outlines the policies and procedures needed for developing the project schedule.

c) Project Cost Management – outlines the policies and procedures needed for planning, managing, disbursement and controlling project cost.
d) Project Quality Management – outlines the policies and activities that will be used to manage and improve the quality of the product.
e) Project Resource Management – outlines the process that will identify, organize, manage and control both the human and physical resources of the project.
f) Project Communication Management – outlines the process that will be used to ensure information is distributed in a timely and appropriate manner, as well as providing the tools to plan, collect, distribute, manage, control and monitor communication.
g) Project Risk Management – outlines the process of conducting risk management planning, risk analysis, risk response strategy development and risk control.
h) Project Procurement Management outlines the process needed to purchase material, equipment and services that are needed to complete the project.
i) Project Stakeholder Management – outlines the processes that are required to identify project stakeholders, develop engagement strategies and stakeholder analysis to manage expectations.

Project Management Plan

A Project Management Plan is a document which details and outlines how a project will be executed, monitored and closed. PMI (2017) describes a Project Management Plan as the baseline of the project and should be used with a reference point when executing the project. The Plan should contain the answers or predetermined responses to questions or issues that may arise while the project is in commission. The Project Management Plan is the objective of the FGP. The inputs, tools and techniques and outputs for developing this plan can been found in Figure 7.

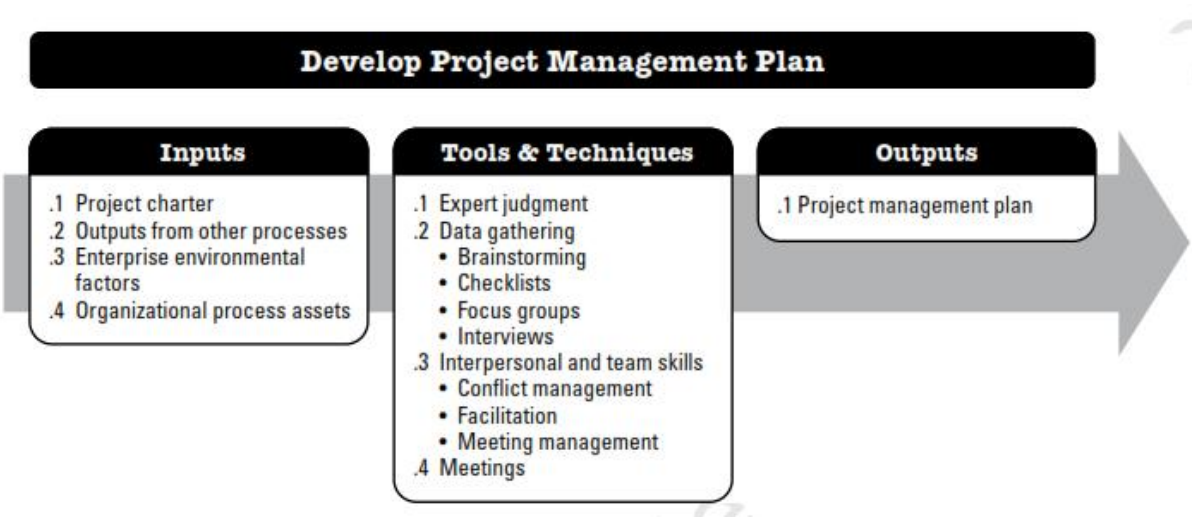

Figure 7 Project Management Plan

Source: (PMI, 2017)

3. THEORETICAL FRAMEWORK

3.1 Information Sources

When carrying out a research the term “information sources” refers to the places where the researcher will gather relevant information regarding the research topic. According to Woodley (2018) there are three different categories of information sources, which are primary sources, secondary sources and tertiary sources. Information sources can include but are not limited to the following: libraries, newspapers, journals, people, information services such as Records Offices or Statistical Institute, Internet, books, interviews, etc. (Walliman, 2011). In the Final Graduation Project, two information sources that will be utilized are Primary sources and Secondary Sources.

Primary Sources

Kothari (2004) defines Primary Source as “those which are collected afresh and are for the first time and thus are original in character”. The University of California Irvine Libraries (n.d) describes primary sources as “documents, images or artifacts that provide firsthand testimony or direct evidence concerning an historical topic under research investigation.”. Examples of primary sources are speeches, documentaries, government publications oral histories, records of organization, etc.

The Primary Source that will be used in the Final Graduation Project is an interview conducted with a Project Engineer who is responsible for executing the Supply and Installation of Generator and Mechanical and Electrical Upgrade Project. The engineer was able to give insight into the current state of the company as well as identify areas of problems. Secondly, the project engineer was able to provide project documents on the current project as well as past project which were used as the framework for the FGP.

Secondary Sources

Secondary Sources are those which have been collected by someone else previously and have already passed through the statistical process (Kothari, 2004). Examples of secondary sources are books, journals, reports, research, etc.

The Secondary Sources that will be used in the Final Graduation project are reports that have been published by BWS, along with other online information from the company website.

Chart 1 Information Sources

Objectives	**Information sources**	
	Primary	**Secondary**
To Create a Scope Management Plan to ensure that the project includes all the work requried to complete the project.	Interview with head Engineer, 2017 Annual Report	Company website, PMBOK Guide 6th Edition
To Create a Schedule Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project schedule.	Interview with head Engineer, project schedule provided by Company	PMBOK Guide 6th Edition
To Create a Cost Managemement Plan in order to establish the policies, procedures and	Interview with head Engineer, Project Budget provided by Company	PMBOK Guide 6th Edition

Objectives	Information sources	
	Primary	**Secondary**
documentation for planning, developing, managing, executing and controlling the project cost.		
To Create a Quality Management Plan in order to identify the quality requirements for the project.	Interview with head Engineer, 2017 Annual Report	Company website, PMBOK Guide 6th Edition
To Create a Resource Management Plan that will define the resources that are required to complete the project.	Project resource list provided by the Company	PMBOK Guide 6th Edition
To Create a Communication Management Plan that develops the appropriate approach and plan for the projecct communications based on stakeholer information needs.	Interview with head Engineer	PMBOK Guide 6th Edition
To Create Risk Management Plan in order to develop	Interview with head Engineer	PMBOK Guide 6th Edition

Objectives	Information sources	
	Primary	**Secondary**
options and actions to enhance oppurtunitiess and to reduce threats to project objectives.		
To Create a Procurement Management Plan in order to document project procurement decisions, specifying the approach and identifying potential sellers.	Interview with head Engineer, Project Resource List	PMBOK Guide 6th Edition
To Create a Stakeholder Management Plan in order to indentify the people or groups or organizations that impact or are being impacted by a decision, activity, involvement, influenece and potentially impact on project success.	Interview with head Engineer	PMBOK Guide 6th Edition, New articles

Source: (Author, 2018)

3.2 Research methods

Kothari (2004) describes research as the “search for knowledge”. Research Methods are tools and techniques used when carrying out a research (Walliman. 2011). Research Methods can be broken down into different types such as Descriptive, Analytical, Qualitative, Quantitative, Applied, Fundamental, etc.

Analytical method

In the Analytical method the “researcher has to use facts or information already available and analyse these to make a critical evaluation of the material.” (Kothari,2004).

Qualitative method

“Qualitative research, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind.” (Kothari, 2004).

Qualitative method

“Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity.” (Kothari, 2004).

Chart 2 Research Methods

Objectives	**Research methods**		
	Analytical	**Qualitative**	**Quantitative**
To Create a Scope Management Plan in order to ensure that the project includes all the work requried to complete the project.	Analysis of the information that was used to establish the scope of the project.		
To Create a Schedule Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project schedule.		Qualitative analysis was used to determine elements such as dependencies and	Quantitative analysis was used to determine the schedule
To Create a Cost Managemement Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project cost.			Quantitative Analysis will be used to determine the budget and contingencies.
To Create a Quality Management Plan in	Quality standard will be		

Objectives	Research methods		
	Analytical	**Qualitative**	**Quantitative**
order to identify the quality requirements for the project.	established		
To Create a Resource Management Plan that will define the resources that are required to complete the project.		Qualitative Analysis will be used to manage human resources.	
To Create a Communication Management Plan that develops the appropriate approach and plan for the projecct communications based on stakeholer information needs.	Analytical approach will be used to determine what is required by the communication plan and how to successfully accomplish it.		
To Create Risk Management Plan in order to develop options and actions to enhance oppurtunitiess and to reduce threats to project objectives.	Analysis will be needed to determine the nature of risk and evaluation to categorize the risk.		Quantitative analysis will be used to calculate the likelihood of risk to occur. That way risk prioritization can be establishing to

Objectives	Research methods		
	Analytical	**Qualitative**	**Quantitative**
			effectively manage risk.
To Create a Procurement Management Plan in order to document project procurement decisions, specifying the approach and identifying potential sellers.	Analysis of information relating to the procurement of goods and services.		
Create a Stakeholder Management Plan to indentify the individuals, groups or organizations that have to potential to impact the outcome of the project, or those who could be affeeccted by a decisions and activities of the project.		Qualitative Analysis will be used to determine what is the best approach to handle the identified stakeholders	

Source: (Author, 2018)

3.3 Tools

Tools are described by the PMBOK Guide 6th edition as “Something tangible, such as a template or software program, used in performing an activity to produce a product or result.”

The tools that will be used in the Final Graduation Project are as follows:

- Interviews - Will be conducted to gain additional information about the Topic of choice for the FGP. The interviews will be conducted with the Lead Engineer of the project.
- Expert Judgement - Experts with knowledge of certain knowledge areas will be consulted to gain or gather more information.
- Data Analysis - Analysis of the information and documentation that is currently available will be conducted for each of the knowledge areas. There will be varying analysis conducted such as alternative data analysis, literature analysis, SWOT and stakeholder analysis.
- Meetings - Meetings are used as a forum to discuss information relevant to the project, get feedback, re-evaluate the position of stakeholders, address changes, make decisions and share information.
- Three-Point Estimating - This tool used the 3 points in estimating instead of one to gain a high chance of accuracy when calculating estimates for the project.
- Project Management Information System - The Project Management Information System that will be used is the Microsoft Soft Project 2016. The Tools will be used to create effective Management Plans for the FGP by computing information and providing visual depictions of the information that has been gathered.
- Critical Path Method -This Tool is used to calculate the fastest project duration. This will come in handy when employing the design of the Schedule Management Plan.
- Communication Requirements - understanding the communication requirements will help to identify the communications needs of the stakeholders involved in the project.
- Communication Technology - The technique that will be used to transmit information among stakeholders.
- Contingent Response strategy - Strategies that are developed but are only initiated if the risk event occurs.

- Source Selection Analysis -This is used to determine which attributes will be taken into consideration during the selection process of procurement. This includes attributes such as price, quality, technical specifications, availability etc.

Chart 3 Tools

Objectives	**Tools**
To Create a Scope Management Plan in order to ensure that the project includes all the work requried to complete the project.	
To Create a Schedule Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project schedule.	Interview, Expert Judgement, Data Analysis, Follow up meeting with Engineer
To Create a Cost Managemement Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project cost.	Expert Judgement, Data Analysis, Three-point estimating, Project Management Information System, Critical Path Method
To Create a Quality Management Plan in order to identify the quality requirements for the project.	Expert Judgement, Data Analysis, Project Management Information System, Analogous Estimating, Three-point Estimating
To Create a Resource Management Plan that will define the resources that are required to complete the project.	Expert Judgement, Data Analysis, Data Representation
To Create a Communication Management	Data Analysis, Interviews, Expert

Objectives	Tools
Plan in order to develop the appropriate approach and plan for the project communications based on stakeholder information needs.	Judgement. Project Management Information System
To Create Risk Management Plan in order to develop options and actions to enhance opportunities and to reduce threats to project objectives.	Communication Requirements, Communication Technology, Expert Judgement
To Create a Procurement Management Plan in order to document project procurement decisions, specifying the approach and identifying potential sellers.	Expert Judgement, Contingent Response strategy
To Create a Stakeholder Management Plan in order to indentify the people or groups or organizations that impact or are being impacted by a decision, activity, involvement, influenece and potentially impact on project success.	Expert Judgement, Source Selection Analysis

Source: (PMI, 2017)

3.4 Assumptions and Constraints

1. Assumption is defined as “a factor in the planning process that is considered to be true, real, or certain without proof or demonstration” (PMI, 2017). The main assumptions that are being made in the FGP are as follows:

- Company sponsor will be available throughout the entire FGP to provide additional information and clarification when needed.
- The information that has been provided is accurate.
- Work can be Completed in the given time.
- Tutor will be supportive and will give timely feedback.

2. Constraint is defined as “a limited factor that will affect the execution of a project” (PMI, 2017). The main constraints during the FGP are as follows:

- Time; there are specific deadline places for each deliverable which adds pressure to complete the deliverables.
- Resources; the resources are very limited as is related to the topic and at times not made available immediately.
- Communication; communication with tutor can be difficult and immediate response to concerns or questions is not possible.
- Geography; being in another country limits the type of communication one can have with the tutor.

Chart 4 Assumptions and Constraints

Objectives	Assumptions	Constraints
To Create a Scope Management Plan in order to ensure that the project includes all the work requried to complete the project.	Time allotted will be sufficient to complete the task; Sponsor will provide support needed to carry out the project; Resources needed will be available	The project must be completed before the start of the active hurricane season. Much of the resources required must be imported
To Create a Schedule Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project schedule.	The information provided in respect to the schedule is accurate and available	Availability of resources will affect the schedule.
To Create a Cost Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project cost.	The budget information received is accurate. Competencies needed by staff to complete tasks are possessed.	Project funds are managed by outside department, which would make change request more difficult.
To Create a Quality Management Plan in order to identify the quality requirements for the project.	The project work is being executed and completed at the requires quality standards	Project team is dependent on Governing Bodies to provide quality checks and approvals which can slow the close of the project
To Create a Resource Management Plan that will define the resources	BWS will supply the needed resources for	BWS uses human resources from within the

Objectives	Assumptions	Constraints
that are required to complete the project.	the project	company and seldom hires new staff to assist on projects. Lack of human resources will slow the progression of the project
To Create a Communication Management Plan in order to develop the appropriate approach and plan for the project communications based on stakeholder information needs.	Communication Requirement will be clear.	BWS culture of poor communication will impact the how well the communications plan is received ad implemented
To Create Risk Management Plan in order to develop options and actions to enhance oppurtunitiess and to reduce threats to project objectives.	Risk will be minimal.	The identified risk have to potential to severely impact the project schedule
To Create a Procurement Management Plan in order to document project procurement decisions, specifying the approach and identifying potential sellers.	The vendors on the prequalified vendor list will be able to provide recourses as they did in pervious projects	Limited vendors in the country of Belize that provide the needed physical resources
To Create a Stakeholder Management Plan in order to indentify the people or groups or organizations that impact or are being impacted by a decision, activity, involvement, influenece and potentially impact on project success.	Stakeholder will be easily identified.	Stakeholder classifications may not reflect the actual reality of the project

Source: (Author, 2018)

3.5 Deliverables

According to the PMI (2017) a Deliverable is “any unique or verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase or project. A deliverable is what is produced after the work has been completed. In the case of the FGP, the final deliverable will be the development of a Project Management Plan for the Supply and Install of Generator and Mechanical and Electrical Upgrade Project.

Chart 5 Project Deliverables

Objectives	**Deliverables**
To Create a Scope Management Plan in order to ensure that the project includes all the work required to complete the project.	WBS WBS Dictionary Project Scope statement
To Create a Schedule Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project schedule.	Project Schedule Activity List and sequence Schedule management plan Templates
To Create a Cost Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, executing and controlling the project cost.	Define Tools to be used Project cost estimates Project Budget Templates
To Create a Quality Management Plan in order to identify the quality requirements for the project.	Quality Requirements Quality Management Plan Quality Measurements Templates

Objectives	Deliverables
To Create a Resource Management Plan that will define the resources that are required to complete the project.	Resource Management Plan Resource Identification Resource acquisition procedures Templates
To Create a Communication Management Plan in order to develop the appropriate approach and plan for the project communications based on stakeholder information needs.	Communication Plan Distributions Methods Communication delivery schedule Stakeholder communication requirements
To Create Risk Management Plan in order to develop options and actions to enhance opportunities and to reduce threats to project objectives.	Risk List Risk Analysis Risk Response Strategy Risk Management Plan Risk Monitoring procedures and templates
To Create a Procurement Management Plan in order to document project procurement decisions, specifying the approach and identifying potential sellers.	Procurement documents Identifies roles and responsibilities Selection Criteria guidelines
To Create a Stakeholder Management Plan in order to indentify the people or groups or organizations that impact or are being impacted by a decision, activity, involvement, influenece and potentially impact on project success.	Communication management plan Stakeholder Matrix Stakeholder engagement plan

Sources: (Author, 2018)

4. RESULTS

4.1 Project Scope Management Plan

The Scope Management Plan will detail the processes that will be used to define the specific work, deliverables, and any other component required to complete the Supply and Install Generator and Mechanical Electrical Upgrade Project for BWS. The project scope will incorporate factors such as the project objectives, expected results, limitations and assumptions. There are six Scope Management processes identified in the PMBOK Guide 6th Ed. They are as follows: plan scope management, collect requirements, define scope, create WBS, validate scope and control scope.

Scope management is particularly important for this project, as BWS has many ongoing operations that happen daily, and it is crucial the project is properly defined so project work is not confused with operational work. The scope will define the work that is the responsibility of the project and the work that is the responsibility of other departments such as the maintenance department or the operations department. This distinction will help the project team planning the project and will ensure that the project resources are applied to only those elements that are within the parameters of the project. Since each department has a budget to perform certain activities, the project manager must define who is responsible for certain actions, or who is responsible for response action if a problem occurs. Effective scope management will benefit the project by conserving resources which can lead to staying within budget and schedule.

The project manager will define the objectives of the project, which will be clear and concise. Activities which do not fall within the scope baseline of the project work will be assigned to departments outside of the project work. For example, the project will not carry out repairs to the existing structure of the stand by facility. Therefore, if it identified that structural repairs are needed the department within the company with responsibility of repairing buildings would have to step in and

carry out that portion of work that does not fall into the parameter of the project work.

Project Scope Statement Development

The Project Scope Statement will define the project work required to complete the project, so that it is clear what is project work and what is not project work. The Scope Statement for the Supply and Install Generator and Mechanical Electrical Upgrade Project will define the nature of the project. It will state key deliverables, it will justify the need for the project, as well as outlined assumptions, limitations, inclusions or exclusions associated with the project work. A well-defined Scope Statement results in establishing the boundaries of the project. The development of the Scope Statement will require the participation of the stakeholders, as it is a requirement to have stakeholders agreement on the project's scope before the project can be approved and executed. Once the Scope Statement is developed and accepted by all stakeholders, it is the duty of the Project Team to adhere to the agreed upon boundaries, as these boundaries guide stakeholder expectations and will be used to evaluate project success.

The following are elements that will be used to develop and define the scope statement for the Supply and Install Generator and Mechanical Electrical Upgrade Project for BWS:

A. Business and Project Objectives: BWS seeks to provide its customers with uninterrupted water supply, particularly in the event of power outages from electricity supplier which cause water pumps to fail. This will be accomplished by the installation of a generator, mechanical and electrical upgrades to the company's western electrical standby facility.

B. Project Constraints:

a) Completion within 4 months
b) Project being conducted in the rainy season
c) Materials needed cannot be purchased locally

d) Work must adhere to all relevant laws such as Labor Act and Social Security Act

C. Project Assumptions:

a) Material and equipment can be found following acquisition process
b) An experienced Contractor will be hired to carry out the work

D. Critical Success Factors

a) Project completed within the 4 months schedule
b) All equipment, mechanical and electrical components are functional upon project completion
c) Project stays within budget

E. Proposed Product:

a) Generator and electrical system installed and functional.

F. Project Exclusions

a) Project will not address structural repairs to standby facility
b) Project will not improve or upgrade fencing
c) Training for generator maintenance
d) Security of facility during or after project as it is the responsibility of BWS to secure all facilities

Work Breakdown Structure

The Work Breakdown Structure (WBS) is a document which breaks down the project into smaller work packages, detailing the activities and deliverables required to complete the project work and in what sequence the work should be executed. The WBS is used to create a visual representation of the work needed to accomplish the product. The Project team will be required to breakdown the project work into smaller work packages across the 5 five process groups and must apply the 100% rule.

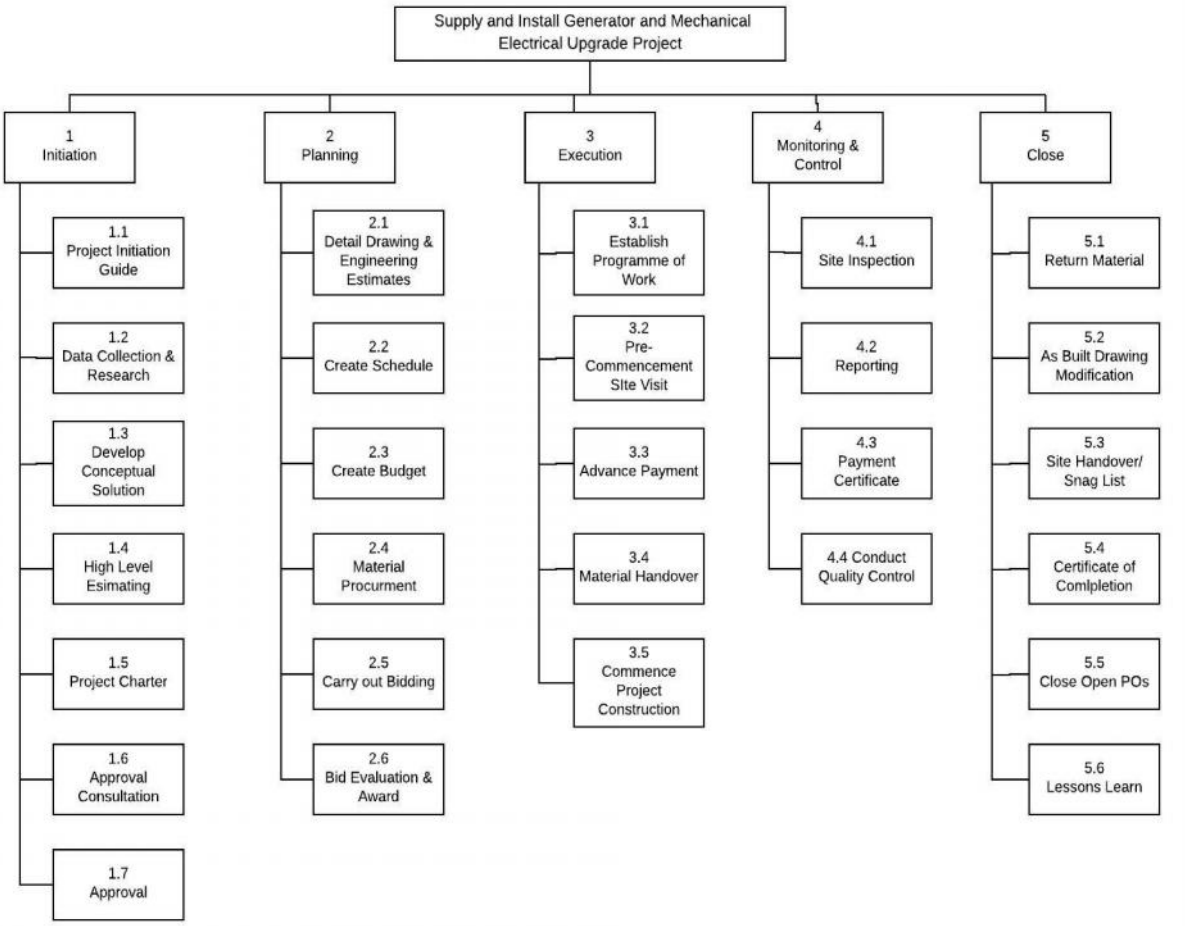

Figure 8 Work Breakdown Structure for this Project

Source: (Author, 2018)

WBS Dictionary

The Practice Standard for WBS 2nd Edition, (2006), defines the WBS Dictionary as tool that “defines, details and clarifies the various elements off the WBS to ensure that each component of the WBS is accurately articulates and can be communicated by anyone referencing the WBS”. The WBS can contain elements such as description of work, deliverables, activities, milestones, estimated cost, acceptance criteria and assumptions. The Work Breakdown Dictionary was filled in by using the information from Figure 8. The Project manager will then need to add

the remaining information to complete the WBS dictionary, description of work and the person or department who is responsible for that activity.

Chart 6 Work Breakdown Structure

Level	WBS ID	Activity	Description of work	Responsible Department/ Person
1		Initiation	Issue permission to begin project planning and development	Executive Sponsors
	1.1	Project Initiation Guide	Develop preliminary statement of works and identify stakeholders	Project Manager
	1.2	Data Collection & Research	The collection of data and all relevant information regarding the project	Project Manager
	1.3	Conceptual Solution	Develop conceptual solutions and drawings	Design Consultant
	1.4	High Level Estimates	Develop high level estimates. Identify equipment, material and human	Project Engineer and Project Manager

Level	WBS ID	Activity	Description of work	Responsible Department/ Person
			resources	
	1.5	Project Charter	Develop charter to be presented for approvals	Project Manager
	1.6	Approval consultations	Meet stakeholders to present conceptual solutions and estimates	Project Manager
	1.7	Approval	Finalize solution and obtain relevant signatures	Executive Sponsor
2		Planning		Project Manager and Project Team
	2.1	Detail Drawing & Engineering Estimates	Prepare detailed drawings, dimensions and quotes.	Design Consultant and Engineer
	2.2	Create schedule	Prepare schedule	Project manager
	2.3	Create budget	Prepare budget	Project manager
	2.4	Material procurement	Prepare list of items needed and bid documents	Project Manager

Level	WBS ID	Activity	Description of work	Responsible Department/ Person
	2.5	Carryout bidding	Invite qualified vendors to bid	Project Manager
	2.6	Bid evaluation	Evaluate bids and award vendors	Project Manager
3		Execution	Start project work	Contractor and Engineer
	3.1	Establish programme of work	Contactor to prepare programme of works	Project Manager
	3.2	Pre-commencement site visit	Site visit with contractor to review programme of works	Engineer, contractor and Project Manager
	3.3	Advance payment	Prepare advance payment	Accounts Department
	3.4	Material handover	Hand over materials to contractor	Project Engineer
	3.5	Commence Project construction	Handover the site to contractor	Project Engineer and Contactor
4		Monitor and Control	Monitor project work as it progresses	Project Manager and Project Engineer

Level	WBS ID	Activity	Description of work	Responsible Department/ Person
	4.1	Site Inspection	Visit site twice a week to check quality of work	Project Engineer
	4.2	Reporting	Prepare and submit detailed report	Project Engineer
	4.3	Payment certificate	Prepare payment certificates to process payments	Project Manager and Accounts Department
	4.4	Conduct Quality Control	Conduct necessary quality control	Project Manager
5		Close	Perform closing activities	Project Manager
	5.1	Return material	The return of any excess materials to BWS	Contractor
	5.2	As built drawing modification	Make modifications to detailed drawings	Contractor
	5.3	Site Handover/ Snag List	Perform inspection with persons who will be responsible for operations of the site	Contractor, District Manager, Maintenance Supervisor, Plant Operator
	5.4	Certificate of completion	Issue certificate after defect liability	Operations Manager

Level	WBS ID	Activity	Description of work	Responsible Department/ Person
			period expires and final site visit	
	5.5	Close open Purchase Order	Inform accounts of open POs that need to be closed	Accounts Department and Project Manager
	5.6	Lessons learn update	Document lessons learned and file	Project Manager

Sources: (Author, 2018)

Scope Baseline Management

The Scope Baseline includes the Scope Statement, WBS, WBS Dictionary and Work Packages, all of which are elements of the scope baseline and therefore, will be vital in maintaining the scope throughout the execution of the project. The project team will be required to monitor and control the project's scope, to ensure that the project's performance during various stages of the project's life cycle is within the scope baseline. The project work that is performed will be compared to the scope baseline to determine if the work performed falls within the scope of the project. In the event scope variation is detected the project team must act to further investigate the cause of the change to the scope and act to resolve.

The project manager will closely monitor the scope baseline by requesting regular status reports and regular discussions at the schedule project team meetings. The scope baseline will be used to keep the project on track and if it is monitored effectively will be able to detect instances where the project work has encompassed work which are to fall under the operational work of BWS and not project work. The scope baseline management will also proactively identify and monitor any unexpected changes to the scope that may develop during the course of the project.

Scope Change

Scope Change is necessary when the project teams identify that elements of the scope must be amended to achieve the successful completion of the project. It is very unlikely that adjustments to the scope will be required for this project, this is based on the outcomes of pervious projects of a similar nature. However, in the event that such discovery is made, the project team will be required to make changes to the scope.

Scope changes require formal change request procedures. The change request will seek to change the scope baseline and will follow the Integrated Change Control Process. BWS will need to establish a Change Control Process which will outline the steps that are to be taken when a change request is submitted. The Change Control Process will require a change control form, establishing a change control processes, documents required when requesting change, communication methods and change integration plan. A sample of the change request form can be found in Appendix 4.

The change control process will be very simple, if the scope requires change this matter should be immediately escalated to the Executive Sponsors. The project manager must present all information related to this change in scope to the Executive Sponsors. The information will be evaluated and analysed and with expertise from relevant parties a decision will be made. Scope change can result in many outcomes such as termination of the project work, temporary work stoppage, increased budget and increased schedule.

The Change Control Process has been integrated into the scope management plan to increase its authority and to signify the importance of the change process. By doing this the change process has been escalated to a level where all project team members are aware of the change control process in the same way they know of other elements of the scope such as constraints or exclusions.

Acceptance Criteria

Acceptance Criteria is the list of required project deliverables; that must be met before the deliverables or product can be accepted. Acceptance of deliverables is determined through the comparison of the acceptance criteria, which is established at the beginning of the project, to the actual results produced after the work has been completed. The project team will use this guide to establish whether activities have met the requirements outlined in the scope baseline, such requirements will be set by the BWS engineers and the project manager during the planning phase of the project. The criteria will reflect the needs and expectations of the project's stakeholders. For this project the Acceptance Criteria can be evaluated in the form of a checklist. The checklist will list all requirements for the deliverable; therefore, when the deliverable is presented as complete, the project team will examine the product received to verify that the criteria for acceptance has been satisfied. At the end of each deliverable the project manager, project engineer and design consultant will review the completed work for that deliverable and determine if the deliverable has met all the criteria and is qualified for acceptance.

Each deliverable may have multiple criteria that need to be met before it is accepted. An acceptance criteria checklist template can be found below in Table 7. This template will be used by the project manager to evaluate whether all the criteria of each deliverable has been met at the completion of that deliverable, this checklist will be updated throughout the project as deliverables are completed. Deliverables that have met all criteria will be accepted and then approved by the project manager, in some cases the approval of a deliverable maybe needed in order to start subsequent deliverable. There must be an approval signature to have accountability in the event a problem arises.

Chart 7 Acceptance Criteria Checklist

Project Deliverables	Description	Criteria for Acceptance	Accepted	Not Accepted	Date
Deliverable 1		Criteria 1 ☐ Criteria 2 ☐			
Deliverable 2		Criteria 1 ☐			
Deliverable 3		Criteria 1 ☐ Criteria 2 ☐			
Deliverable Acceptance Approval					
Deliverable 1	Approved By: Approval Date:		Comments: (state if not accepted at any time, reason and action taken)		
Deliverable 2	Approved By: Approval Date:		Comments: (state if not accepted at any time, reason and action taken)		
Deliverable 3	Approved By: Approval Date:		Comments: (state if not accepted at any time, reason and action taken)		

Source: (Author, 2018)

4.2 Schedule Management Plan

The Schedule Management Plan will define all the procedures associated with the project schedule and successfully execute the Supply and Install Generator and Mechanical Electrical Upgrade Project within the identified project constraints. The project manager will be tasked with the responsibilities of planning the schedule, managing and monitoring the schedule activities. This plan will outline the methodology that will be used to plan and manage the schedule; it will determine

the tools that will be used, units of measure, level of accuracy, variance thresholds, reporting formats and process management.

To develop a practical plan, the project manager must incorporate the detailed information regarding the project's scope of work (work to be done), the WBS, order in which the work is to be performed, risks, constraints and assessment of the time to resources ratio. The project manager and the project team will use information from the scope management plan and the risk management plan to obtain statement of work and project risk, respectively. Verzuh (2015), suggests taking a systematic approach which should be done in several iterations until best possible balance is found among the constraints of the project. The following planning steps are suggested:

1. Breakdown project work - using the work breakdown structure (WBS) and further elaborating the WBS, the project team must identify all tasks required to achieve project deliverables.
2. Identify the relationship between tasks - this requires the sequencing of task (work packages) in the order in which they occur, taking into account dependencies.
3. Estimate work packages - team will estimate the resources needed to deliver tasks. Resources such as labour, materials and duration of tasks.
4. Calculate schedule - Calculate the duration of the project. This calculation may need to be updated as the project is being executed due to variations from actual project progress.
5. Level resources - Resource constraints are taken into consideration and adjustments are made to task schedules that may be affected

Schedule Tools

The scheduling tool which will be utilized is the Microsoft Project 2016 software. This tool will allow the project team to plan project schedule and monitor scheduling activities by defining project milestones, identifying dependencies, organizing activities and sequencing, tracking progress and lags, manufacturing

reports and monitoring schedule variances. This project management software is a powerful program that allows the project team to not only plan, but also monitor project progress in real time. This software will be used in the planning and monitoring of other process such as resource management and procurement management which will be directly related to developing the project schedule plan, as it will allow for sharing of information across the entire project management plan.

Chart 8 Schedule Tools

Level of Accuracy	**Units of Measure**	**Variance Thresholds**
Project team will establish contingencies to account for the uncertainties in the schedule estimation. For projects of this nature BWS has historically used a contingency of 10% Higher risk activities may be given a greater contingency reserve depending on market status and other potential impacting factors	Project durations is measured in days. Project cost is measured in Belize Dollars (BZD) Project contingency reserves is measured in percentages (%)	Schedule variance will be calculated using the formula: Schedule Variance = Earned Value - Planned Value A negative Schedule Variance means project is behind. A positive Schedule Variance means the project is ahead. A zero Schedule Variance means the project is on schedule.

Source: (Author, 2018)

Schedule Reporting

Reports will be required bi-weekly. The project manager will request schedule reports from the project team members and contractors throughout the project until its completion and compare the actual schedule to the planned schedule to determine whether the activities for that period have been completed within the estimated time. The results from these reports will alert the project manager if adjustments are required. The Communications Plan will be used to shape schedule reporting as it will lay out the proper communications protocols for reporting.

Activity Identification

This is the process of identifying the work needed to achieve specific deliverables. This will be done by the decomposition of the information from the WBS, along with additional information gathered from Expert Judgement. The project team will be required to research and collect data from the expertise of engineers, design consultant, documented lessons learned and organizational process assets. The project manager and team will examine each deliverable and detail every action required to achieve it. For example:

Chart 1 Activity List Example

Activity ID No.	Activity Name	Description
2.9	**Sign Contract**	Signing contract after vendor or contractor is chosen
2.9.1	Obtain all necessary stipulated insurances	Ensure insurance is valid and cover the construction period
2.9.2	Schedule date and time for contract signing	Schedule and inform all signatories of the contract signing

Activity ID No.	Activity Name	Description
2.9	**Sign Contract**	Signing contract after vendor or contractor is chosen
2.9.1	Obtain all necessary stipulated insurances	Ensure insurance is valid and cover the construction period
2.9.3	Insert bond, securities and insurances into original contract	These items must be inserted before the contract is presented to the CFO
2.9.4	Signing of 2 originals	Contractor, supervisor, CEO and engineer to initial contract value, form of contract, non disclosure and bond

Source: (Author, 2018)

Chart 9 is an example of how the team is expected to breakdown all project deliverables. The output of this process will be an activity list which will name the activity and give description of each activity as shown in the above example.

Activity Sequencing

Sequencing of project activities is the process by which the project team will determine the order in which project tasks will be performed. This is done by determining the relationship between tasks. Doing this will reveal sequencing constraints and meaning task that must performed before other tasks. A predecessor is a task that must be completed before another task can begin. This is the method of sequencing the project team will use to schedule the project. For example, in Chart10, in order for the Project Initiation Guide development process to begin the discussion of requirement must be completed and Project Approvals can be granted on when the proposed project solution is approved. Therefore, that approval is dependent on preceding tasks.

Chart 9 Predecessor List Example

ID No	Task Name	Predecessors
1	Project Initiation	
2	Discuss requirements	1
3	Project Initiation Guide	2
4	Data collection and research	1, 2
5	Conceptual Solution and High-level estimates	3, 4
6	Consultations for Approval	5
7	Meet with stakeholders	6
8	Finalize solution	5, 7
9	Approval for solutions	8
10	Project approval granted	9

Source: (Author, 2018)

Estimating Duration

Estimating project duration is the process of estimating how much time is required to accomplish each task; project team will estimate the duration of task from initiation to completion. There are several tools and techniques that can be used to achieve estimating. The team will utilize Three-Point Estimating which will estimate 3 durations and the mean to define a better range of the duration of a task. The three-points are:

- Most likely (tM)
- Optimistic (tO)
- Pessimistic (tP)

After establishing the 3 durations that are most likely to happen, the optimistic duration that focuses on everything going as planned and the pessimistic duration that takes into consideration worse case scenarios such as realization of risks, the project team will use the following formula to calculate project duration estimate:

$$tE = (tO + tm + tP) / 3$$

Parametric Estimation will also be used to aid in estimating durations, this technique uses historical information from past projects to gather durations of similar activities. Parametric has the potential of giving significant and more accurate information as it is based on historical data and lessons learned which can be improved upon, ultimately curving risk that are associated with the schedule that may arise.

Updating, Monitoring and Control

Monitoring the status of the project schedule throughout the life cycle of the project is crucial to determining the performance of the schedule at any given point in the project. This process will alert the project team of poor performance and indicate issues as it relates to the project schedule, resources and cost. Monitoring the schedule will require the gathering of information and comparative analysis against the estimated variables.

Activities schedule will be monitored by comparing actual performance to planned performance which can be documented in a Schedule Assessment Form such as Chart 10.

Chart 10 Schedule Assessment Form Template

Schedule Assessment Form Project Name: _____ Project Manager:_____ Date:_____ Time Period: _____ to _____	Deliverable for time period: Submitted by:

Activity ID No.	Activity	Planned Start Date	Actual Start Date	Planned End Date	Actual End Date	Notes: (justifications, response, etc.)

Project Manager Report:

Requires Action: Yes_____ No_____

Attached Documents _____ (Example: change request, risk response approval, issue log entry, etc)

Project Manager Signature:

Source: (Author, 2018)

Also, the project manager can use Microsoft Project to track schedule variations, the Gantt Charts will identify variations such as Lead or Lags and will evaluate and give visual representation of the overall project performance. For this project the engineer and contractor will have to fill out the Schedule Assessment Form and submit it to the project manager. The project manager will then analyse the information and proceed with the necessary action, if action is indeed required. After analysis, if a response is required, the project manager will use the Risk Management Plan as guide to activate response. This information will be updated into the Microsoft Project Software as well as the Schedule Management Plan; and the necessary processing of paperwork will be carried out, such as Change Requests, Issues Log and all other Project Forms will be updated and filed.

4.3 Cost Management Plan

The purpose of the Cost Management Plan is to outline the processes involved in planning the project budget, monitoring cost throughout the life cycle of the project, and controlling the project budget. These processes work together with the collective goal of ensuring the project is completed within the budget and ultimately within the scope of the project. The project will be funded by BWS and will comply with the existing policies that govern procurement. This project is a part of a larger Company initiative to upgrade the infrastructure country-wide, this means when the budget is approved it is important that the project execution remains within the budget as the company's financial resources are in high demand.

In order to arrive at an estimated project cost, the project team will need to analyse the following:

- Schedule Management Plan
- Project Scope
- WBS for the project
- Risk Management Plan
- Company procurement policies
- Market conditions such as known shortages of materials, etc.
- Past project estimates and historical cost performance

To arrive at the budget for the Supply and Install Generator and Mechanical Electrical Upgrade- Benque Project, the project team will break down the project deliverables into smaller work packages, then all the physical resources for each task will be listed and assigned costs. In addition to physical resources, the project team will also need to assign costs for required services and labour. Historical data will be a huge asset in determining a preliminary project budget as BWS performs numerous projects of this nature and many of the resources are purchased regularly, therefore, accurate preliminary pricing would be available until official quotations are received. Appendix 8 shows the project budget for physical resources, services needed and labor as prepared by Project Engineer and Project Manager of BWS. The project team must establish the following schedule tools as seen in Chart 11.

Chart 11 Cost Tools

Level of Accuracy	**Units of Measure**	**Variance Thresholds**
The acceptable range for cost estimates is ± 10 % of the estimate. Project team will establish contingencies to account for the uncertainties in the budget estimation. For projects of this nature BWS has historically used a contingency of 10% of the estimated budget. Higher risk activities may be given a greater contingency reserve. Depending on market status and other potential impacting factors.	Project durations is measured in days. Project cost is measured in Belize Dollars (BZD) Project contingency reserves is measured in percentages (%)	Schedule variance will be calculated using the formula: Cost Variance = Earned Value - Actual Value A negative Cost Variance means project is over budget. A positive Cost Variance means the project is within budget. A zero Cost Variance means the project is on budget.

Source: (Author, 2018)

The project cost is one of the most important elements of the project scope and the cost baseline; therefore, it is imperative that the project team establishes the

method by which cost performance will be measured. The Cost Variance is defined in Table 11 and will be used to monitor the progression and performance of the budget.

Rules for Performance Measurement

Project team will measure project performance by using the Earned Value Management (EVM) method, which will integrate the project scope, budget and resource to be used for monitoring the project progress. This method can be used in both and cost as the two are so interdependent. The figure below is a graphical representation of EVM.

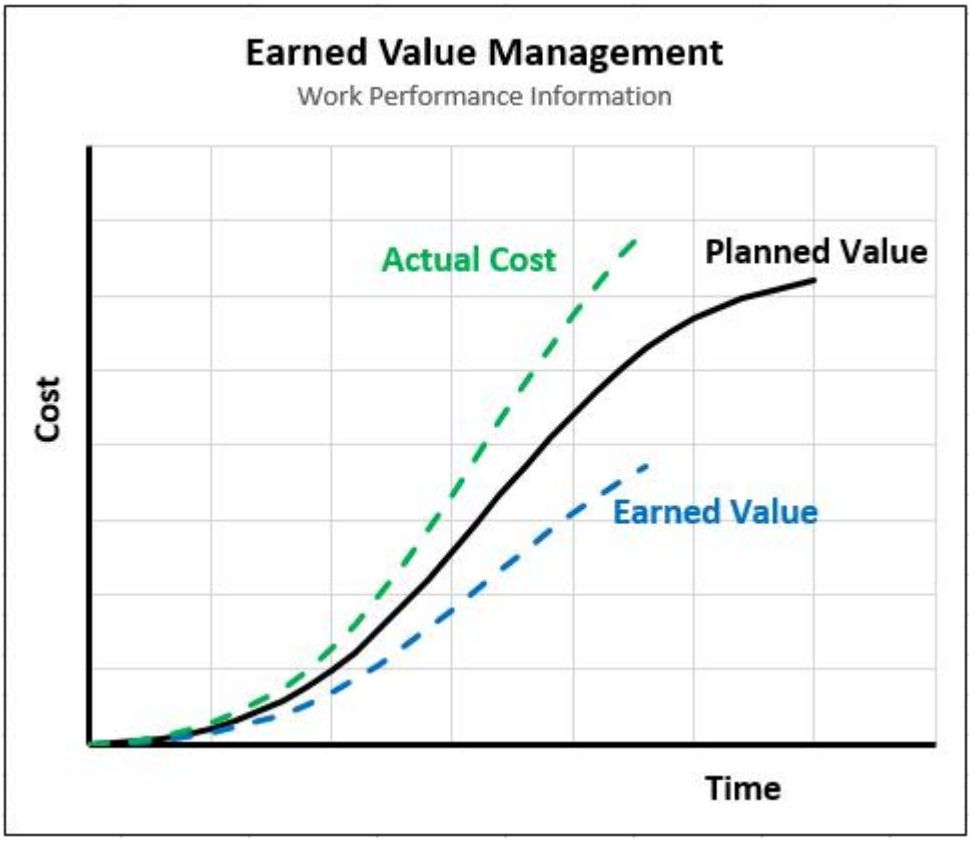

Figure 9 Earned Value Management Chart

Source: (Project Engineer, 2018)

The project team will use the Cost Variance and Cost Performance Index (CPI) to evaluate the financial accuracy and performance of the project. Cost Variance will determine measure whether the project cost has remained within the planned budget of if it has deviated negatively or positively. While the CPI will measure the efficiency of the project, this is calculated using the following formula:

CPI = Planned Cost / Actual Cost

If the ratio is higher than 1 this means the project is performing well within the budget. A CPI of 1 means that project is on budget. If it is less than 1 this means the project over budget.

Cost Reporting and Format

The project manager will analyse the project budget on a bi-weekly basis to ensure that the project budget is on track with planned estimates. The following factors are associated with the cost reporting:

- The Approved budget
- Expenditure to date
- Cost variations detected

Estimating costs

In order to accurately estimate the project budget, it is recommended that the project team use more than one estimating technique. The two main estimating techniques that will be used are Analogous Estimating and Three Point Estimating. Analogous Estimating uses cost information from similar projects as the basis for estimating like elements within the project. Three-Point Estimating, as explained in the Schedule Management Plan, uses 3 points of estimation to determine activity cost in order to produce a greater level of accuracy. The three-points of estimates are as follows:

- Most likely (cM)
- Optimistic (cO)
- Pessimistic (cP)

The formula used to calculate this estimating technique is as follows:

$$cE = (cO + cm + cP) / 3$$

Using this formula, the project team will be able to determine the range of uncertainty as it relates to the estimated cost.

Developing the budget

The Budget will consist of the approved cost estimates and the contingency reserves, while the management reserves will remain in reserves by management until the project is completed. The contingency reserves will be 10% of the budget and the management reserves are 5 % of the project budget. BWS will provide the funding for the project, after the budget has been approved by the Executive Sponsors the CFO will authorize the availability of funds so the project work can begin.

Cost Control

The project team will exercise control over the project by constantly monitoring the performance of the cost throughout the lifecycle of the project. The project team will use Earned Value Analysis and Variance Analysis to determine the status of how the project budget is performing. The project team will need to determine a course of action for different scenarios so that in the event that a specific result occurs the project team will know how to move forward. If the cost performance is poor the project team may perform further analysis such as Forecasting to determine what the likely budget will be at the completion of the project, results from this analysis would then provoke a response.

4.4 Quality Management Plan

The Quality Management Plan will delineate how quality requirements of the project will be maintained throughout the lifecycle of the project. This management plan will be developed during the planning stages of the project. The project manager, project engineer and project consultant will participate in the

development of this quality plan. BWS has guidelines in place which dictate quality standards of products and projects. Whether it be civil, mechanical or water and wastewater there are policies, codes and regulatory criterion that must be followed. BWS has in house quality assurance department which assesses all work after completion to ensure that all policies are followed. However, during the execution of the project the project team will be tasked with ensuring that the project meets all quality requirements.

The Quality Management of the project will be created around the policies and regulations that have been established by BWS and other bodies of authority. The primary objective in managing the quality of this project is to ensure that the project product, which is the installation of a generator and electrical upgrade at the Benque Viejo Del Carmen standby station, meets stakeholder expectations at the close of the project. The focal point of the quality management plan will be based on the goal of delivering an effective generator installation and electrical upgrade to the facility which will provide customers with uninterrupted service.

The Project Management Team will meet and brainstorm to develop the quality management plan, they will use professional knowledge and organizational assets to identify the deliverables, determine quality expectations and requirements for each deliverable, identify measurement tools and establish cost of quality.

The project team will first identify the deliverables of the project, which can be broken down into the following main activities:

1. Power Upgrade (transformer installation)
2. Generator Installation
3. Motor Installation
4. Electrical Distribution System Installation
5. MCC Equipment Installation

Roles and Responsibilities for Quality Management

Initially the Quality Management plan will be developed by the Project Manager, Project Engineer and Project Consultant. During the planning stage, the roles and responsibilities of team members throughout the implementation of the quality plan will be defined. After the plan is approved and implementation begins, the project team will assign tasks to team members to support the maintenance of project quality. The roles and responsibilities will be documented in a table, such as the template layout in Chart 12.

Chart 12 Responsability Assignment Matrix Sample

Quality Responsibility	Project Manager	Project Engineer	Project Consultant	Quality Inspector
Example 1: Verify that all contractors have current and active License.				
Example 2: Acquire approval for service disconnections for the purpose of works				
Example 3: Acquire approval from the Commission for the connection of equipment to electrical systems				
Example 4: Inspect MCC installation				

Source: (Author, 2018)

Tools of Quality Assurance

Maintaining project quality will require the utilization of specific tools and techniques to plan and implement the plan. The following outlines the tools that will be used.

A. Expert Judgement: The project team will utilize the expertise of team members and consult experts when necessary. These persons will use professional and educational knowledge to advise and guide the planning process. Expertise and consulting will be required from:

a) Project Manager
b) Project Engineer
c) Project Design Consultant
d) Public Utility Commissions contact person
e) BWS quality control department
f) BEL contact person

B. Meetings: Meetings will be conducted during the planning stages to gather information from the entities that can contribute to the knowledge gathering process. Furthermore, meeting will be used in to manage and control phases to discuss progress and unforeseen issues.

C. Brainstorming: This technique will be used during the planning, managing and controlling processes to develop quality approach and to develop solutions to quality deficiencies that may be realized.

D. Test and Inspection: This tool will be used at the end of every major project deliverable to ensure that design, technical, safety and regulatory quality requirements are being met.

Testing will be executed internally by the project engineer and project team to ensure that the deliverable design and execution of work,s results in the expected outcome. Inspection will be executed by bodies of authority and those bodies who hold jurisdiction over a particular area of work such as the PUC and BEL. Scheduling of the inspections will occur at the end of deliverable, where necessary, or at the completion of project work.

Project Quality Definition

The team will determine the specifications of each of the identified deliverables. Further, the project team will then identify the organization's policies, public utilities standards and government compliance that are applicable and needed to meet quality requirements. Through the use of professional expertise and knowledge from previous projects similar in nature the project team will use the regulations of the Public Utilities Commission (PUC), who acts as the country's Utility Regulator. BWS has already integrated some of the PUC's regulations into company policy as they are required for the day to day operations of the company. In addition to BWS operations policy the following documents from the Utility Regulator will be used to ensure that requirements are upheld and work is carried out within the parameters of the law.

1. Water Industry Act
2. Public Utilities Commission Act
3. The Electricity Act

Quality Measurement

The quality Management Plan will be used throughout the lifecycle of the project, it is important that the plan is translated into meaningful actions. Quality assurance activities that have been outlined in the Quality Management Plan will require check and balance to ensure that responsibilities assigned are being completed. One measurement tool that will be used is the use of checklists and audits. Project Team will develop a quality requirements checklist for each of the identified deliverables and as that deliverable is being achieved the checklist will be used to guide project engineer or contract of the quality progress. The project manager will be responsible to conduct audits which will seek to find out if quality is being achieved and will reveal shortcomings. Each checklist will be unique to the specific deliverable that it sets out to govern. The checklist will include the identified quality requirements specified by company policies and government laws.

The findings and feedback from the checklist and audits will divulge the status of the project's quality standards at that particular point in the project. In the event of

unsatisfactory quality progress, the project manager will be prompted to make changes to the Quality Management Plan, which can be done by a formal change request.

Chart 13 Template of Deliverable Quality Checklist

Project: _____

Deliverable: _____

Responsibility of: _____

Role: _____

Start Date: _____

Quality Requirement	Status		Comments
	Completed	Not Completed	

Project Manager Approval: ___ Yes ___ NO Date:

Project Manager Rejection ___ Yes ___ NO Date:

_____

Project Manager Signature

Project Manager Comments:

Related/ Supporting documents:

Source: (Author, 2018)

Quality Improvement

Quality improvements are intended to enhance the Quality Management Plan in the areas that have been recognized as falling short of imagined results. The process of making improvements will be done using quality reports that provide information gathered from feedback through audits and evaluations of deliverable

quality. By analysing the information, the project team will be able to identify the specific problem areas that are failing. Root Cause Analysis is a tool that can be used to identify the exact cause of a failure. Once a cause is identified the project team can then use problem solving methods to generate a solution to address the problem.

4.5 Resource Management Plan

Project Resource Management is the framework that outlines the processes that will be used by BWS to identify, acquire and manage the resources needed to execute the project throughout the project's lifecycle. Resources are essential to every project, as resources are the infrastructure on which projects are built and executed. Resources are the building blocks and foundation of the activities and tasks that are needed to complete the project, therefore properly managing resources is crucial as the quality of the resources will have a direct impact on the success of the project.

The PMBOK Guide 6th edition lists the processes for Project Resource Management as Plan Resource Management, Estimate Activity Resources, Acquire Resources, Develop Team, Manage Team and Control Resources. The Project Manager in developing the Resources Management Plan will need to incorporate the elements of each process that are needed for the Supply and Install Generator and Mechanical Electrical Upgrade Project.

The Purpose of this Plan is to effectively manage project resources of the BWS Supply and Install Generator and Mechanical Electrical Upgrade Project, as this project will carry both human and physical resources. It is important that the project defines how the resources are to be managed as often resources are shared across several projects which are being executed simultaneously. The human resources are current BWS employees as well as consultants that will be brought

in to contribute expert judgement mainly in the design phase. Like the human resources, physical resources will be a mix of internal and external resources but most of the major resources will be supplied by external supplies.

Plan Resource Management

Plan Resource Management process define how the BWS project team will estimate, acquire, manage and utilize human and physical resources. The resource which requires close management is human resource element of this project as there is no current governance outlined by the Company.

Identification of Resources

Human Resources

The project will not require the acquisition of staff as there is already staff in place to carry out the project work. The human resources breakdown is as follows:

1. Project Sponsors (Technical Service Manager and Operations Manager)
1.1. Operations Manager
    1.1.1. Project Manager
        1.1.1.1. Project Engineer
            1.1.1.1.1. Contractor
    1.1.2. Project Design Consultant
    1.1.3. Project Assistant

Chart 14 is a sample of how the Roles and Responsibilities of human resources will be identified and defined. The project manager will fill out the table after he has identified all the human resources that will be required to complete the project. The project manager must identify the person and the role, define the level of authority that individual has within the project, as well as, the competencies that individual must possess to fulfil the requirements of the role.

Chart 14 Roles and Responsibilities Resources

Name	Role	Authority	Competencies
Dave Pascasio Sanjay Keshwani	Sponsor	Approve project start Approves budgets Authority to approve or reject change request Request Reports	In depth knowledge of company goals and initiatives. Professional knowledge
Dave Pascasio	Operations Manager	Gives authority to Project Manager Approves schedules and management plans	Professional knowledge of operations management, engineering and water utilities operations Ability of manage resources Knowledge of and ability to use Project Management Software
Andrew Cutkelvin	Project Manager	Authority to delegate task and create management plans.	Professional knowledge of engineering and water utilities Communication, reporting, and managerial skills. Ability to plan, organize, lead, delegate and motivate.

Name	Role	Authority	Competencies
			Knowledge of and ability to use Project Management Software
Shawn Pollard	Project Engineer	Request design changes. Delegate work to contractors Authority over acquire physical resources	Professional knowledge of engineering Knowledge of and ability to use Project Management Software.
Allan Sharp	Project Consultant	Authority to provide guidance during project execution.	Ability to identify and develop engineering designs. Monitor and ensure project meets specifications and design. Ability to identify issues and faults in project work.
Melissa Coleman	Project Assistant	None	Ability to be organized. Professional knowledge of Project Management Ability to communicate excellently.

Source: (Author, 2018)

Physical Resources

Physical resources will need to be acquired by external suppliers, some material will be provided from internal inventory of BWS. This process will utilize Organizational Process Assets such as historical information and lessons learned about past suppliers; previous knowledge about suppliers and the quality of materials and equipment will be beneficial to this process. Physical resources will be identified through meetings, brainstorming and collaboration of the Operations Manager, Design Consultant and Project Sponsors after the initial design has been approved. The use of expert judgement and analogous estimating will be used to estimate the quantities of material and equipment that will be needed for the project. Analogous Estimating is the estimating technique which uses data from previous projects with similar components.

Physical Resources breakdown:

1. BEL Power Upgrade
2. Generator
3. Motor
4. Electrical Distribution System
5. MCC Equipment

The physical resources will be broken down into more details, as in Chart 15. The information will be used later in the project as contributions to the cost and schedule section of the project management plan.

Chart 15 is a high-level estimate of the physical resources that will be needed to execute the work of the project. The project team, primarily the design consultant and the engineer, must brainstorm to make a list of all the items needed to perform the work for each deliverable. In this example the project work was broken down into 5 major deliverables, as listed above, the resources needed for each deliverable is listed as well as the quantities needed. For instance, Deliverable 2 is

the Generator, the physical resource needed is the Wye Generator. The specification are given for the generator. In this same manner the project engineer will list all the components needed to successfully complete the deliverable.

Chart 15 Supply and Install Generator, and Mechancal and Electrical Upgrade equipment and material high level resources breakdown estimate

No.	Description	Estimated Qty
1	BEL Power Upgrade	
1.1	225kVA 480/277V Padmount Transformer Installation (480V Upgrade)	
2	Generator	
2.1	80kVA, 1800 rpm, 480V, 3Ph, Wye Generator	
3	Motor	
3.1	15HP, 230/460V, 3Phase, 1.15 S.F. Submersible Motor	
3.2	10HP, 230/460V, 3Phase, 1.15 S.F. Submersible Motor	
4	Electrical Distribution System	
4.1	Main Breaker Disconnect - 200A, 600V, 10KAIC, 100% Rated, LSIG Trip Unit, NEMA 1 Enclosure	1
4.2	Surge Protective Device - 480/277V, 3 Phase, Wye, 180kA per Phase, Diagnostic Lights	2
4.3	Surge Protective Device - 208/120V, 3 Phase, Wye, 120kA per Phase, Diagnostic Lights	1

No.	Description	Estimated Qty
4.4	Automatic Transfer Switch - 200A, 480V, 3Phase, 10KAIC, Neutral Bar, All Standard Metering, Adjustable Voltage & Frequency Pick-Up/Drop-Out, Adjustable Time Delays, Closed Transition System	1
4.5	Main Distribution Panel - 480/277V, 3Phase, 4W, 10KAIC, 200A Cu Bus, 200A 100% Rated Main Breaker, 24Cts, NEMA 1 Enclosure	1
4.6	Breaker - 60A, 3Pole, 480/277V, LSIG Trip Unit	2
4.7	Breaker - 50A, 3Pole, 480/277V, LSIG Trip Unit	1
4.8	Breaker - 30A, 3 Pole, 480/277V, LSIG Trip Unit	1
4.9	Breaker - 60A, 3 pole, 480/277V	1
4.10	Breaker - 40A, 3Pole, 480/277V	1
4.11	Breaker - 30A, 3 Pole, 480/277V	1
4.12	Step-Down Dry Transformer, 30kVA, 480V:208/120V Y, Type 1, Aluminum	1
4.13	Safety Disconnect Switch - 60A, 3P, 10KAIC, 600V, NEMA 3R	2
4.14	Safety Disconnect Switch - 50A, 3P, 10KAIC, 600V, NEMA 3R -> 30A	1
4.15	Safety Disconnect Switch - 30A, 3P, 10KAIC, 600V, NEMA 3R	1
4.16	Lighting Panel - 208/120V, 3Phase, 4W, 10KAIC, 225A Cu Bus, 100A 100% Rated Main Breaker, 42Ct, NEMA 1 Enclosure	1

No.	Description	Estimated Qty
4.17	Breaker - 15A, 1Pole, 208/120V	13
4.18	Breaker - 30A, 1Pole, 208/120V	1
4.19	Breaker - 30A, 2Pole, 208/120V	2
4.20	Breaker - 50A, 2Pole, 208/120V	1
4.21	Breaker - 60A, 2Pole, 208/120V	2
4.22	Erico Copper Grounding Bus Bar - EGBA18212GG	1
5	MCC Equipment	
5.1	ABB Voltage Monitor WVM Series 480V 3 Phase (WVM911RN)	1
5.2	Contactor 20HP @460V	2
5.3	3Ph 60A Terminal Block	2
5.4	Grounding Bar Kit W/11 Terminal Positions #ECLX071M	1
5.5	Hoffman AFLT86 Filter	1
5.6	Hoffman AVK86SS6 Louvers	1
5.7	Cooper Storm Trapper Metal Encased Distribution (480V) - Surge Arrester	2
5.8	120V Time Relay Coil DILET ETR4-11-A	2
5.9	120V Relay Coil DILER-22 (120)	2
5.10	600V Circuit Breaker 40A-63A #NZMB2-A63-BT-NA	2

No.	Description	Estimated Qty
5.11	GS4 20HP AC DRIVE 460VAC 3 PHASE - GS4-4020	2
5.12	LINE REACTOR 460VAC 20HP 3PH DRIVE INPUT OR OUTPUT, 3% IMPEDANCE - LR-4020	2
5.13	EATON MINITATURE CIRCUIT BREAKER, 15A, 277VAC/48VDC, 1POLE, C CURVE, 14KA SCCR, 35MM DIN RAIL MOUNT	2
5.14	EATON MINITATURE CIRCUIT BREAKER, 2A, 277VAC/48VDC, 1POLE, C CURVE, 10KA SCCR, 35MM DIN RAIL MOUNT	1
5.15	STEGO SETPOINT THERMOSTAT, NORMALLY OPEN (CLOSE ON RISE), 32 TO 140F SETPOINT, 35MM DIN RAIL MOUNT	1
5.16	Hubbell-Wiegmann enclosure, NEMA 3R/4/12, 72 x 36 x 24in (HxWxD) - WRD723624FS4	1
5.17	Hubbell-Wiegmann subpanel, 69 x 33in, 12-gauge carbon steel, white, polyester powder coat finish - NP7236	1
5.18	Stego Filter Fan Plus FPO enclosure fan assembly, exhaust, with air flaps, 11.46 x 11.46in enclosure cutout, NEMA 12, 115 VAC operating voltage, 414 CFM, light gray, (4) 6-position ratchet lever mount, indoor use only - 018849-00	1

Source: (Author, 2018)

Acquire Resources

Human Resources are typically pre-assigned as they are already employed by BWS. In the event there is a need to acquire new staff or to add or to replace members of the project team, the Operations Manager will submit updated job position profile and make a formal request to the project sponsor. The sponsor will either reject or approve. If approved by sponsor, the sponsor must formally request staff acquisition to the Executive Sponsor and once approved the Human Resource Department will be provided with information to begin the recruitment process.

Physical resources will be acquired from a shortlist of trusted suppliers that have been previously vetted and who have ongoing business relationships with the company. In some case, there is only one supplier available to supply a service, material or equipment. For example, the Belize Electricity Limited is the only company or service provider that may install the needed transformers (1.1), as it is stated by the Belize Electricity Act Part 4 section 32 (2000).

The project team will consider the following supplier:

- Belize Electricity Limited
- Armstrong Power Systems
- Pump & Motors of Belize
- Agrimech
- Automation International

Develop Team

The Project Manager will organize efforts to build skills and competencies of members of the project team and managing body who works closely with the project team. The areas on which the trainings will focus are developing skills to use newly acquired Microsoft Project Software and Leadership development. Chart 16 outlines the training details. The information in chart 16 contains the information regarding training activities. Chart 16 identifies the targeted group or individuals, the training courses and the goals the project manager hopes to accomplish by having team members participate in these team development activities. This table

can be filled out after the project manager has determined who will participate in the training and in what areas will the team members train. the project manager has worked with the team members before, as they are permanently employed by BWS, he will have some knowledge of strengths and weaknesses of team members; therefore, he will be able to identify the areas which need improvement and will be able choose trainings that will be beneficial to the development of the project team.

Chart 16 BWS Training Outline

Groups/ Individual	Training Course	Goal	Notes
Project Manager Project Team Operations Manager	Project Management and MS Project (level 1) Project Management and MS Project (level 2)	Train project staff to effectively use MS Project which was recently acquired by BWS.	Training will be hosted locally by SaiInfo-Tech. Cost: $446.00 per person to be paid for by BWS. Requires: 2 full day out of the office per Level
Project Manager	Leadership Development	This training is geared towards providing employees in leadership positions with the tools to improve	Training will be hosted locally by SaiInfo-

Groups/ Individual	Training Course	Goal	Notes
Operations Manager		and develop their leadership skill which ultimately improve the team dynamic.	Tech. Cost: $446.00 per person to be paid for by BWS. Requires: 2 full day out of the office

Source: (Author, 2018)

Manage Team

The Project Manager will be responsible for managing staff relations. The immediate project team will consist of mainly four members. Even so, the project manager will need to utilize and develop skill in areas of conflict management within the team and as is required in the broader management of external stakeholders. Also, team building activities should be scheduled in order to collaborative and amicable working environment. As mentioned in the Communications Management Plan, the Project Manager will organize trainings for himself and the project staff to improve skills needed to use the Project Management Information System, as well as, training to developing interpersonal skills.

Team assessments should be carried out at the midpoint of the project and then again during closing phase of the project. The Project Manager will assign dated to these assessments during the scheduling of project events. A sample of the assessment form can be found in Appendix.

The Project Engineer along with the Project Manager will be tasked with developing the project schedule and making updates to the Project Management Information System (PMIS). The PMIS will be used to plan, monitor project progress and store updated project information over the course of the project.

Control Resources

The Project Engineer will be responsible for receiving, dispensing and keeping inventory of the physical resources once the items have been turned over to him and dispatched to the construction site. The Engineer will need to keep log using the PMIS of what resources have been issued, when they were issued and what task those resources completed. The engineer will report this information to the project manager as often as requested. Recording the information on resources expenditures will highlight salient changes such as resources shortages and surplus. This process will call attention to areas which need immediate modification, areas such as the schedule and the cost baseline. If changes are deemed necessary, the project manager along with the expertise of the engineer and design consultant will meet and identify a solution to solve the unforeseen problem. The solution will then be submitted to the project sponsor and if need be in the case of additional funding to the executive sponsor for approval.

4.6 Project Communication Plan

Communication is defined by the Merriam Webster Online Dictionary as “a process by which information is exchanged between individuals through a common system of symbols, signs and behaviours”. Communication is a significant factor to the outcome of a project. Therefore, all projects require the development of a Communication Plan that will outline the methods which the Project Team will use to achieve constant and effective communication with all relevant parties throughout the project life cycle. The Supply and Install Generator and Mechanical Electrical Upgrade Project will need to develop a Communication Management Plan that encompasses the processes as recommended by the PMBOK Guide 6th

Ed. (2017). The Communications Management Processes are Plan Communications Management, Manage Communications and Monitor Communications.

The purpose of the Communications Management Plan is to guide the timely communication of information as well as defining the methods of communication, frequency of communication, identify roles and responsibilities and identifying all stakeholder needs and any other conceivable interferences that may impact the project communications.

Communication skills are critical for project managers to possess. It is important that Project Managers have exceptional command of oral, written and verbal communication. It is through the usage of these skills that the Project Manager will facilitate the high quality of communication that the project will require. This project will require communication within and between various Stakeholder Groups. Information will be transferred within and among the project team, suppliers, company staff and all other stakeholders whose involvement is required throughout the life of the project.

There are several components to the communication process - The Sender, the Message, the Channel, Noise and the Recipient (R. Jones Jr., 2013). Jones explains that the participants are the Sender and the Recipient of the messages in the communication encounter; the Message is the content being conveyed from the sender to the recipient. The Sender must encode the message to be sent, encoding is the process of turning thought or information into a message. After the encoding has occurred the message is sent through a Channel over which the message travels to the Recipient. The Recipient then Decodes the message into information or thought, the Recipient then encodes a new message (feedback) which is sent to the original Sender who must decode and determine if the original message was interpreted correctly. This Process will require constant management and monitoring of the project's communications in order to maintain an effective and viable communication strategy. See Figure 2.

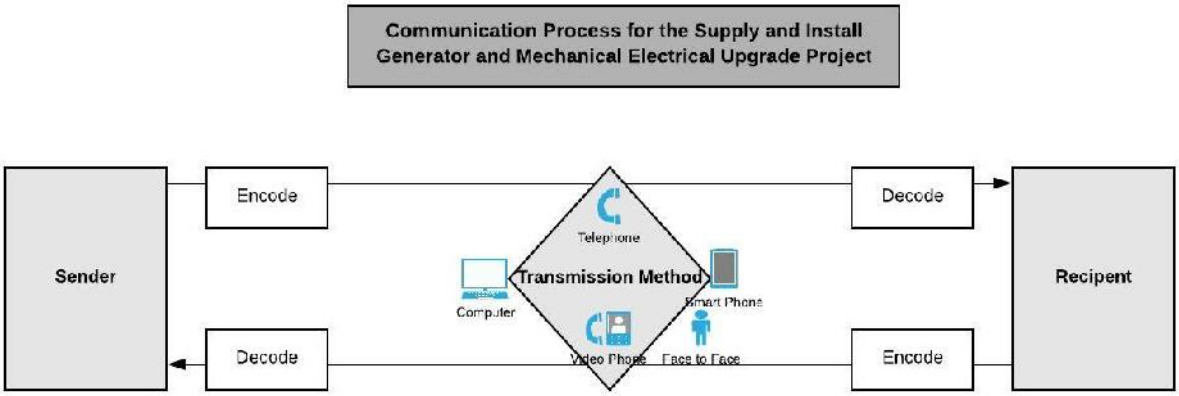

Figure 10 Communication Process Diagram

Source: (Author, 2018)

The Project Communication Management Plan of this project will follow the processes outlined in the PMBOK Guide 6th Edition. The three processes are listed and described by the PMBOK as follows:

Plan Communications Management - During this stage the Project Manager must plan all aspects of the dissemination of information, including stakeholder requirements, information to be shared, communication tools, communication schedule, guidelines for communication, etc.

Manage Communications - Project Manager will determine the guidelines or rules for communication, for examples meeting formats, approval procedures, acceptable email correspondence procedures, meeting minutes, etc.

Monitor Communications - In order to ensure all stakeholder needs are met the Project Manager must put in place checks and balances to evaluate the effectiveness of the Communications Plan and the Project Teams adherence to the agreed upon communication guidelines. Project Manager can put in place

evaluations, audits, periodic check of correspondence logs archives and staff training. Regular assessments can uncover shortcoming to the Communications Plan and prompt adjustments to improve areas of limitations.

Communication Management Plan

The Supply and Install Generator and Mechanical Electrical Upgrade Project being carried out by the Belize Water Services Limited (BSW) will outline the approach that will be used throughout the project to provide Stakeholders with information. This plan will identify the Stakeholder Requirements, the information (message) to be sent, method of communication, frequency and persons with responsibility to carry out the activity. The Project Manager is responsible to create a communication management plan that will result in a more productive environment. The project manager will create a plan that will outline the recommendations and agreements for communication. The plan will be a written guide which will contain the strategy to be used to communicate information to people at the appropriate time.

Though this project is similar to other project performed by BWS in the past and may have an overlap of stakeholders, it is important that the project manager and project team still carry out the communication needs identification process, as stakeholder may be the same but the level of communication may change. The project manager will ask two important questions,

1. Who needs information?
2. What information is needed?

As a part of the communication plan the project manager will be required identifying the following:

- The frequency of contact for each stakeholder
- Information will be transferred in the communication
- Schedule for progress meetings
- Methods of communication to be used

Stakeholder Communication Requirements

The Communication Requirements for each Stakeholder Group are to be identified as they are identified and documented in a table such as Chart 17. In this table the project manager will identify the communication requirement and the purpose of the communication. As in the example in chart 17, the Board of Directors will require reports and the purpose of this communication is to provide updates on project status. Each stakeholder group will require the same communication requirement breakdown, resulting in a filled in table such as the one below. The Stakeholder Communication Requirement table serves as a tool to document critical project information, which will help with the effective monitoring of communication within the project. The information will be properly documented and accessible to guide communication throughout the project.

Chart 17 Stakeholder Communication Requirements Examples

No.	Stakeholder Group	Communication Items	Purpose/Goal
1	Board of Directors (Steering committee)	Reports	Update on project progress, issues or changes
2	Project Team	Status updates, reports and change request	Communicate project progress
3	Material & Equipment Suppliers	Delivery status, bids, expert opinions and change updates	Communicate status of supplies and equipment
4	District Manager	Training, notice and advisories	Provide Employees with information that should be passed on to customers

No.	Stakeholder Group	Communication Items	Purpose/Goal
5	Partnering Utility Company (Belize Electrical Limited)	Request confirmations	Request cooperation during project execution
6	Customers	Notice and advisories	Provide Customer with appropriate advisories as it relates to service interruptions
6	Operations Team (Engineers)	Reports, project updates and progress	Provide updates on the status of the project

Stakeholder Communication Strategies

The Channels of Communication to be used to distribute the named communication items are Groups Meetings, Emails, Phone calls, Text Messaging, Written Letters, Oral Communication, Posters, Brochures and Telemedia Advertisements. The Project Manager, along with the Project Team, will schedule communication activities. All this information will be compiled in table such as Chart 18. This Table will be filled out by the project manager using the stakeholder information and the relevant communication strategies set out by the project team. The Table will contain critical information pertaining to the communication of each stakeholder group; such as the goal of the communication, the message, method of communication, frequency of communication and person responsible for organizing or carrying out the communication.

Chart 18 Stakeholder Communications Strategies

Stakeholder Group	**Goal**	**Message**	**Communication Method**	**Timing & Frequency**	**Responsible**
Board of Directors	Project Status updates	Start and Finish of the Project	Meeting	Quarterly Board meeting	Project Manager submits report.
Project Team	Transparency among stakeholders and management of all communications	All relevant project information	Meetings, emails and phone calls	Will meet weekly and biweekly to discuss the progress of the previous weeks work and project performance, respectively. Meetings can be held on a need's basis. Emails will be used to convey the day to day activity on a need's basis.	The Project Team will elect one team member (communications officer) who will work along with the Project Manager to organize, disseminate, monitor and log all communication.
Material & Equipment Suppliers	Provide status updates to Purchaser	Communicate the availability of materials and equipment as well	Meetings, emails and Phone call	During procurement stage email requests for bids will be sent by email followed by meeting with	Project Communication officer will be task with making sure all communication

Stakeholder Group	Goal	Message	Communication Method	Timing & Frequency	Responsible
		as delivery dates and overall status		qualifying suppliers. After contract is awarded progress can be tracked by phone one week prior to delivery date.	activities occur on schedule activities.
District Employees	Keep customers enlighten on Company improvement plans for the community and any service interruptions associated with the upgrades.	BWS is improving service for the. Up grades will cause temporary service interruptions.	Verbally inform customers that visit district office. Pass out brochures and place posters in office.	This should begin one week prior to the start or project work and service interruptions and carry through to the end of the project.	District Employees will carry out the execution of this communication; however, the narrative and plan will be prepared by the communication office.
Partnering Utility Companies	Coordinate effort with other utilities to aid in the execution of the project.	Request temporary electrical disconnection at various stages of	Meeting, letters and emails	Meeting will be held during the planning stage, followed by exchange of written requests and reply	The project manager will arrange meeting and formal written request. The

Stakeholder Group	Goal	Message	Communication Method	Timing & Frequency	Responsible
		installation and testing.		10 days after meeting and lastly, email advisory one week before project work start date.	communication officer will send out email advisory.
Customers	To keep customers informed on the impact of the project work to the community	Announcements of service interruptions due to project work	TV and radio advertisements as well as text message broadcast. Verbally inform customers that visit the branch.	TV and radio announcements will start to run three days prior to the scheduled interruption. Text message broadcast will be sent 24 hours prior and morning of.	The communications officer will be responsible for organizing all communication activities.
Operations Team (Engineers)	Provide Expert Opinion and status updates during execution	Communicate Expert opinions and updates on project work.	Meeting, emails and Phone calls	Meetings will be held during the planning phase. Scope of work exchange changes and approvals will be done via email.	Project Manager

Source: (Author, 2018)

4.7 Risk Management Plan

The Risk Management Plan seeks to manage the uncertainties in the project in an organized manner, which will increase the likelihood of successfully meeting project objectives. A risk is seen as any unexpected event that has a potential of threatening the success of the project but can also be an unexpected event that positively affect the project. The purpose of risk management is to decrease the probability of bad events while increasing the probability of positive opportunity generating risk. The project manager is expected to manage project risk and be prepared to respond to risks whether they are ‘known unknowns’ or ‘unknown unknowns. Verzuh (2016) describes known unknowns as events that are expected but the degree at which they may or may not occur is not known. Contrary to that, unknown unknowns are events that occur that were not foreseen by the project manager.

The project manager and the project team will be expected to prepare for risk and reduce uncertainty. The risk management development process will require the project manager and team to identify risk, analyse and prioritize, develop response plan and monitor risk. The risk management process should begin at the start of the project and will be repeated throughout the project as new information becomes available or in the event scope of work changes. The key factor is looking at the project deeply and critically to identify weaknesses and to prepare plan of action to implement if a risk is realized.

Risk Management Procedure

The project team must plan how they will systematically manage the risk of project; risk management strategies will be developed to neutralize harmful risks. To achieve proper risk management, detailed planning must be conducted at the conception of the project, throughout the planning phase and should be iterated throughout the life of the project.

The PMBOK Guide 6th edition (2017) details the processes entailed in developing the Risk Management Plan, the processes are as follows:

- Plan Risk Management
- Identify Risk
- Perform Qualitative Risk Analysis
- Perform Quantitative Risk Analysis
- Plan Risk Response
- Implement Risk Response
- Monitor risk

The planning of the risk management will be led by the project manager; however, the expertise of the project team and the input of other stakeholders will be needed to complete the tasks. Developing the risk management will require a considerable amount of communication and will rely on the guidance of the communications plan. From the onset of the project team will use due diligence to identify risk; the team will discuss the glaring and potential risk associated with the project. Those risks will be analysed and prioritized by examining the probability of occurrence and the likely impact of the risk. Further, the risks will be prioritized by probability and impact, this will provide information to help the project team decide which risks require the most and least attention and resources. The next process will be the development of the risk response. Based on the threat posed by the risk, the project team will develop an appropriate plan to decrease the risk occurrence and in the event that the risk does occur, a response plan will be developed to correct the impact of the risk to the project work. Lastly, and most critical is the continuous risk management which is key in identifying risk status, changes in the risk probability and when is the appropriate time to intervene and respond to risk.

Risk Identification

Verzuh (2016) recommends using the following techniques to aid in the risk identification process:

- Information gathering form stakeholder by way of interviews and meetings

- Creating a risk profile, that is making a list of the risks that have been identified
- Using information from lessons learned from past project of a similar nature
- Focusing on constraints in the schedule and budget that may lead to risks

The project team of the Supply and Install Generator and Mechanical Electrical Upgrade Project can utilize the above techniques in the risk identification process of the project. The project team will meet with stakeholders and through the medium of brainstorming and interviewing will gather information about issues that may give rise to project risks.

Expert Judgement will be critical in this project because of its technical nature, therefore, the project manager must rely heavily on the expertise of engineers, contractors, suppliers and governance bodies to gather all the relevant information that is available. The advice and information given by experts will be an important factor in customizing the risk management of this project. Expert judgement will advise on areas such as the current market state, weather predictions, availability of materials, possible shortages, importation delays etc.

From the information gathered in the risk identification exercises the project manager will create a Risk Breakdown Structure (RBS), which will serve to organize the information in such a way that will allow the information to be further analysed and understood. The PMBOK Guide 6th Edition (2017) offers a sample demonstrating the structure of the RBS which can be used in the project (p. 406).

The Risk Breakdown Structure (RBS) is the hierarchal representation of project risks. The Risk Breakdown example below was filled in using the identified risks for this project. A RBS can have as many levels as seen fit, often times depending on the complexity of the project. This example (Chart 19) has 2 levels, Level 1 represents the categories of risk and Level 2 represents the risk that fall within each category. The project team for the Supply and Install Generator and Mechanical Electrical Upgrade Project will in this same way fill out a RBS that is specific to the project.

Chart 19 Risk Breakdown Structure Example

RBS Level 0	RBS Level 1	RBS Level 2
0 Source of Project risk	1 Technical Risk	1.1 Flawed design
		1.2 Availability of materials in appointed time
	2 Management Risk	2.1 Poor staff performance
	3 Commercial Risk	3.1 Limited Suppliers and vendors
	4 External Risk	4.1 Weather/ hurricane
	5 Regulatory	5.1 Licenses, approvals and inspections

Source: (Author, 2018)

Risks can further be examined and defined by investigating the cause and consequences of each individual risk. The project team manager, in collaboration with the project team, will scrutinize each risk to determine the root cause of the threat, then the consequences of the risk will be presumed and documented. This information can be documented in a table such as the example provided in Chart 19.

In the Chart 20 each risk must be listed, these risks will be taken from the list of identified risks, this activity is done prior to this activity. After risks are listed the project team must determine the cause of each risk, this will be done by performing analysis activities such as root cause analysis. Furthermore, the consequence of each risk must be determined and entered into the table.

Chart 20 Risk-Cause-Consequence Table Example

Risk Code	Risk	Cause	Consequence
1.1	Flawed design	Design consultant did not use the latest industry standards in design plan	Project is halted, more time required to review scope of work and resources requirements
1.2	Availability of materials at appointed time	Inability to find reliable supplier who can deliver on schedule	Delayed project while resources can be fulfilled
2.1	Poor staff performance	Inability to communicate effectively and low morale due to poor leadership	The project quality will be lower, need for rework due to miscommunication and unsuccessful project outcome
3.1	Limited suppliers and vendors	Due to the uniqueness of the project some of the material needed may not be widely available, there are only a limited buying options locally.	BWS must source products regionally or internationally. Local buying will not yield best prices, no competitive pricing
4.1	Hurricane or inclement weather	Natural Disaster, flooding	Halted work, damage to completed deliverables, lost of material/ equipment inventory
5.1	Delays in	Requirements not met to	Schedule halted while

Risk Code	Risk	Cause	Consequence
	licenses, approvals and inspections	gain licenses, approvals or inspections	needed documentations can be acquired

Source: (Author, 2018)

Risk Analysis

PMBOK Guide 6th edition (2017) defines this process as the prioritization of individual risk for further analysis by assessing the probability of occurrence and impact. The project manager and project team will be required to assign definitions to risk impacts and probability. By doing so, the project team will qualify and give contextual value to each risk. This information will be used in the qualitative risk assessments which will be used to prioritize risk and help the project team determine the appropriate risk management strategy. Chart 21 and Chart 22 provide examples of the probability and impacts definitions, respectively.

Chart 21 Probability Definition Example

Probability Scale	
Scale	**Probability**
Very Low (1)	Very low probability of this happening as it has not happened before
Low (2)	Low Probability, has happened once
Medium (3)	Medium probability, this has occurred 3 times before
High (4)	High probability, this has happened more than 5 times
Very High (5)	Very High probability, this usually happens

Source: (Author, 2018)

Chart 22 Impact Definition Example

Scale	Describes Impact on Major Project Objectives			
	Cost	Time	Quality	Scope
Very High (5)	>$80K	> 12 weeks	Overall project functionality will be affected; project fails to meet purpose	Project fails to meet primary purpose
High (4)	$65K to $80K	9 to 12 weeks	Quality reduction is unacceptable to sponsor	Scope reduction unacceptable by sponsors
Medium (3)	$45K to 65K	4 to 8 weeks	Quality reduction requires Sponsor approval	Major areas of scope affected
Low (2)	$10K to $45K	3 to 4 weeks	Only very demanding applications are affected	Minor areas of scope affected
Very Low (1)	No significant cost increases/ > $10K	No significant time increase/ < 2 weeks	Quality degradation is barely noticeable	Scope decrease barely noticeable
Nil	No Change	No Change	No Change	No Change

Source: (Author, 2018)

Risks have two characteristics: the probability that it may realize and the impact it would have if it did. A risk impact assessment is the process of assessing the probabilities and the magnitude of the consequences of risk events if they are realized. The results of this assessment are then used to prioritize risks on a scale of most critical to least critical. In Chart 23 the defined impact and probability metrics for the project are quantified in terms of resulting impact on time, cost and project quality.

Chart 23 Impacts and Probability Scale Example

IMPACT	**PROBABILITY**	**Impact (+/-) on Project Objectives**		
		TIME	**COST**	**QUALITY**
VERY HIGH (5)	5	> 81 days	> $80K	Overall project functionality will be affected. Project fails to meet purpose
HIGH (4)	4	61-80 days	$65K-$80K	Quality reduction is unacceptable to sponsor
MEDIUM (3)	3	41-60 days	$45K-$65K	Quality reduction requires sponsor approval
LOW (2)	2	21-40 days	$10K-$45K	Only very demanding applications are affected
VERY LOW (1)	1	< 20 days	<$10K	Quality degradation is barely noticeable

IMPACT	PROBABILITY	Impact (+/-) on Project Objectives		
		TIME	COST	QUALITY
NIL	<5	No change	No change	No change in functionality

Source: (Author, 2018)

Probability and Impact Matrix

The project manager and project team will use the probability and impact definitions to estimate the probability and impact of each risk and illustrate these estimations in Probability/Impact Matrix such as the one below in Chart 24. It is important that the same metric is used throughout the entire project to ensure that information is accurate; in this matrix impact and probability have been ranked from 1 to 5.

The project team will assign a score to each risk, one for impact and one for the probability. For example, if Risk 4.1 (Hurricane/Weather) is given a probability score of one (1) and an impact score of four (4) the Pxl score would be four (4) because 1*4 = 4

Probability * Impact = Prioritization Value.

After a Pxl score is assigned to each risk, the risk is placed in the matrix, which is a visual representation of the risk prioritization. This will give the project team clear insight into which risk will require the most and least attention. See Figure Probability/Impact Matrix.

Chart 24 Probability & Impact Matrix

Impact / Probability	Very Low 1	Low 2	Moderate 3	High 4	Very High 5
Very Low 1	1	2	3	4	5 **Risk 1.1**
Low 2	2	4	6 **Risk 2.1**	8 **Risk 3.1**	10
Moderate 3	3	6	9 **Risk 5.1**	12 **Risk 4.1**	15 **Risk 1.2**
High 4	4	8	12	16	20
Very High 5	5	10	15	20	25

Source: (Author, 2018)

The following threshold is used to differentiate the priority of the risks:

- Low Priority: Those risks whose PxI value ranges between 1 and 5.
- Medium Priority: Those risks whose PxI value ranges between 6 and 10.
- High Priority: Those risks whose PxI value ranges between 12 and 25.

Chart 25 Probability Impact Matrix Legend

Probability Impact Matrix Legend		
Yellow	Medium priority	6-10
Red	High Priority	12-25
Green	Low priority	1-5

Source: (author, 2018)

Based on the Pxl matrix the project team will make a prioritization list, the list will breakdown the risks in terms of highest priority to lowest priority. This list will be used to guide the project team when developing risk response strategies. The following figure (Figure 14) is an example of the risk prioritization list.

Figure 11 Risk Metrics

Source: (Author, 2018)

Risk Response

Having ranked risks in order or prioritization the project team will analyse and develop the appropriate risk aversions for each risk. The output of this process is the risk response strategy that could potentially eliminate, control or mitigate risk. The main risk strategies outlined by PMI are as follows:

- Escalate: Risk will be moved up the organization to be addressed by the sponsor, execute sponsor or board of directors
- Avoid: Risk is eliminated
- Transfer: Ownership of the risk are handed over to another party
- Mitigate: Actions are taken to decrease the chance of risk occurring
- Accept: No action to intervene is carried out

To arrive at the risk response strategy for each individual risk, the project team will meet to discuss each risk, weighing which of the above mentioned strategies is best suited. The team will choose risk strategies by utilizing tools and techniques such as expert judgement, organizational assets, and brainstorming, together with the process of elimination. The risk responses should be based on factors such as nature of the risk, cost of response versus potential cost of risk, consequence and practicality of implementing a strategy. For example, the threat of a hurricane. There is no way the project team can avoid this; however, the project team can accept the risk and mitigate to decrease the consequences such as loss of property by moving materials and equipment to a safe location. On the other hand, a risk such as poor staff performance can be avoided, and after weighing all options, avoidance may be the most cost-effective strategy to manage the risk.

The approval of the selected risk response strategies will be given by the operations manager, who is also the project sponsor. Equally important, is the implementation of the agreed upon risk responses. Implementation will be carried out by the project team. The implementation of the strategies is carried out throughout the project lifecycle, in a continuous manner that ensures that the

determined strategy is applied, not only at the appropriate time, but also in the prescribed manner.

Risk Monitoring

Imperative to the Risk Management Plan, is the monitoring of the risk response implementation. This final process will require the project manager to evaluate and monitor the risks, risk will continue to be analysed and strategies will be revaluated to ensure that with the changing nature of project variables those strategies are still relevant and applicable to the current status of the risk.

The risk register will be used to document all the risk information that has been gathered. The project team will be required to keep a risk register and regularly update the information in the register as new information becomes available or as risk status changes. Risk Register template can be found in Appendix 9. To carry out risk monitoring the project manager will use a template such as the one in Figure 15 to monitor the status of each risk. The project manager will fill in the known information and revaluate each risk to detect if there is change as well as monitor the risk response.

4.8 Procurement Management Plan

The procurement management process looks for planning the execution of the project procurement. The BWS will supply some of the resources needed for the project; however, most of the resources and some services will need to be outsourced from external suppliers. Furthermore, the project manager and project team will have to determine the actions and governance of every step of the procurement process.

The procurement process will begin after the project resources have been determined and finalized. After resource requirements have been defined, the project manager and the project team can begin to plan how they will acquire the resources. The Resource Management Plan and BWS predetermined procurement policies that will be used to guide the project team in developing the procurement plan.

This management plan will detail the following:

- Procurement procedures
- Roles and responsibilities
- Contract Type
- Selection Criteria
- Bid procedures
- Contract Signing

Procurement Procedures

The procurement process will have well defined procedures that must occur in order of specified instruction. The project manager will plan the procurement and define the procedures involved in carrying out the critical project process by using the organization’s policies, industry standards and guide from PMBOK Guide. After the project manager has completed the procurement management plan and has

received the necessary approvals to start procurement of resources, the following steps will follow:

1. Gather Procurement Documents
    1. Review Federation of Consulting Engineer Standard to re-evaluate Technical specifications
    2. Tailor bid document (inputs: Bill of Quantity template, technical Specifications and detailed plan drawing)
    3. Approval of bid documents
2. Invitation to Bid and Conduct Pre-Bid Meeting
    1. Clarifications should occur
3. Receive Bids
    1. Bids should be deposited in sealed bids received box
4. Bid Opening
    1. Should occur in the presence of Project Manager, Operations Manager and Internal Auditor
5. Bid Evaluation
    1. Evaluate based on acceptance criteria
6. Award Bid
    1. Inform winning Supplier
7. Contract Document
    1. Prepare draft contract for review
    2. Prepare for signing
8. Contract Signing
    1. Final review to make sure stipulations are met
    2. Sign Contract
9. Contract Filing
    1. Originals are filed
    2. Copies are issued to project manager and project engineer
10. Letters to unsuccessful Bidders are sent out

Roles and Responsibilities

The Belize Water Services has a procurement department which the project manager and project team will work with to procure the necessary resources for the project. The project manager will define the roles and responsibilities of the project team and that of the procurement Department. The project manager and project team will bear the sole responsibility of finding suppliers, defining the resource requirements and creating and submitting requisitions for resources. The procurement department will be responsible for issuing purchase orders, registering new vendors and keeping track of contact payment terms.

Chart 26 Procurement Roles & Responsibilities

BWS	Role	Responsibilities
Project Manager	Project Leader	⟩ Guide Project Team ⟩ Correspond with Purchasing Department ⟩ Get approvals from Operations Manager ⟩ Plan Procurement Management ⟩ Aid in contract preparations ⟩ Carry out selection process
Project Team	⟩ Support the project manager in executing project	⟩ Generate Vendor list ⟩ Send out RFQ ⟩ Organize Pre-Bid Meetings ⟩ Gather Procurement

BWS	Role	Responsibilities
		Documents and Organizational Assets - Carry our Bid Award Announcement Contract Filing - Provide expertise
Operations Manager	Sponsor	- Draft contracts - Get signatures from TSM
Purchasing Department	Purchasing Manager	- Ensure funds have been approved for the project - Prepare and Issue Purchase Orders - Ensure vendors meet necessary business requirements - Ensure vendor information is up to date
Technical Service Department (TDS)	Technical Service Manager (TSM)	- Sign contract

Source: (Author, 2018)

Procurement Documents

Procurement documents are the documents that are needed to develop the procurement plan and activities. The procurement documents that will be utilized by this project are as follows:

- Pre-approved seller list: list of vendors that have been used previously to provide resources in past projects and are in good standing with the company. This list can be found in the Resource Management Plan.
- Requirement documents: approved technical requirements, organizational requirements and PUC requirements
- Roles and responsibility assignments
- Resource requirements (human resources and physical resources)
- Organizational assets documents (lessons learned archives and company contract policies)
- Federation of Consulting Engineers Standard
- Templates: BoQ, contract, letters, bid documents, specification sheets, bid format, etc

Contract Type

A contract is a formal agreement between a buyer and supplier of goods or services; contracts typically elaborate the details of an agreement, defining the price, payment disbursement, delivery schedules, to name a few. BWS will issue a Fixed-price contract to winning vendors. A set price will be agreed upon and will be paid in two parts for contract over $50,000.00 BZD; 50% of the contract value is due 10 days after signing the contact and the remaining 50% of the contract value to be paid 10 days after the handing over of goods or services and inspection approvals. For contract under $50,000.00 BZD; the contract value will be paid in one lump sum within 30 days of handing over of goods or services and inspection approvals.

Selection Criteria

Source selection analysis involves the evaluation of bids and the selection of the most appropriate bids for the project. The bid submissions will be evaluated by the project manager, internal auditor, operations manager and representative from the office of the CFO. The Evaluation Committee will examine the technical specifications offered and the cost, according to the project engineer the committee

will “determine the lowest evaluated bid which is the bidder with adequate capability and capacity and highly responsive, and lowest or reasonable/ justifiable bid price” Pollard, (2018). He goes on to say that the lowest bidder is not always the lowest evaluated bidder.

4.9 Project Stakeholder Management Plan

The Project Stakeholder Management Plan is the instrument used to identify and analyse Project Stakeholders. It also ensures that the expectations of those stakeholders are managed and they are engaged. The analysis of stakeholders will help the Project Team in categorizing the stakeholders order of highest to lowest in areas such as power, impact and interest. These results will allow the project team to prioritize stakeholders. Prioritization of stakeholders will assist the project team in developing a stakeholder management plan with strategies that are contrived for all stakeholders.

PMI (2017) describes a stakeholder as “an individual, group, or organization that may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project”. Stakeholders are classified as internal stakeholders or external stakeholders. Internal stakeholders are those groups or individuals within an organization while external stakeholders are groups or individuals on the outside. PMI (2017) outlines four processes required to conduct successful stakeholder management, the processes are Identify Stakeholders, Plan Stakeholder Engagement, Manage Stakeholder Engagement and Monitor Stakeholder Engagement.

Identify Stakeholders

Identify Stakeholders is the process of identifying stakeholders and acquiring relevant information regarding their interests, involvement, influence and impact on the project (PMI., 2017). This process will give the Project Team the information required to determine the stakeholder engagements which will need greater focus.

According to PMI (2017), the Identify Stakeholder Process should occur “prior to or at the same time the project charter is developed and approved”. It is also recommended that the process is repeated after the development of significant change to the project or organization and after each project phase (PMI, 2017).

The Project Manager will conduct Stakeholder Analysis which will gather quantitative and qualitative information. The Analysis also explores the relationship between the project and stakeholders as it identifies interest, expectations and influence of stakeholders (PMI, 2017). This is process is made easier because BWS performs several projects of like nature each year, therefore there is a known stakeholder list. For this project the project manager will identify stakeholder process to include or exclude any of the known stakeholder. Given that each project is different, the project manager must still carry out this process to ensure that each stakeholder is applicable to the current project. Having a stakeholder list from past projects will lessen the time of the stakeholder identification process but will not eliminate it.

When identifying who should be considered project stakeholders, it is important to examine whether the entity being considered is connected to the project in any of the following ways:

1. Is this group or individual affected by the project?
2. Is the group or individual in a position which can influence the project’s outcome?
3. Does the group or individual have impact on resources?
4. Does the group or individual benefit from the project?
5. Does the group or individual have cause to resist the project?
6. Will the project require skills or expertise possessed by the group or individual?
7. During what part of the project will the group or individual have to most influence?

A Stakeholder Register will be created using the information collected during the identification of stakeholders' activity. The register will better organize the information which helps with further stakeholder analysis. This analysis examines potential impacts or influence each stakeholder could possibly have produce. Chart 27 is a sample of a Stakeholder Register.

Chart 27 Stakeholder Register Template

Name	Position	Role	Contact Information	Requirements	Expectations	Influence	Classification

Source: (Author, 2018)

To assess the position and impact of each stakeholder on the project, a Stakeholder Register provides the information for further analysis; this information will be used to create a Power/Interest Analysis which will further classify stakeholders. PMI (2017) describes the Power/Interest grid, the grouping of stakeholders based on their level of authority/power and their level of concern/interest. Figure 13 is an example of a Power/Interest grid. The Grid is divided into 4 quadrants keep satisfied, manage closely, monitor and keep informed. The project team will determine which quadrant each stakeholder should be placed in. For example, The Board of directors must be kept satisfied and informed, whereas, the contractor must be managed closely. Based on the information in the Stakeholder register the project team will fill out the Power/Interest grid.

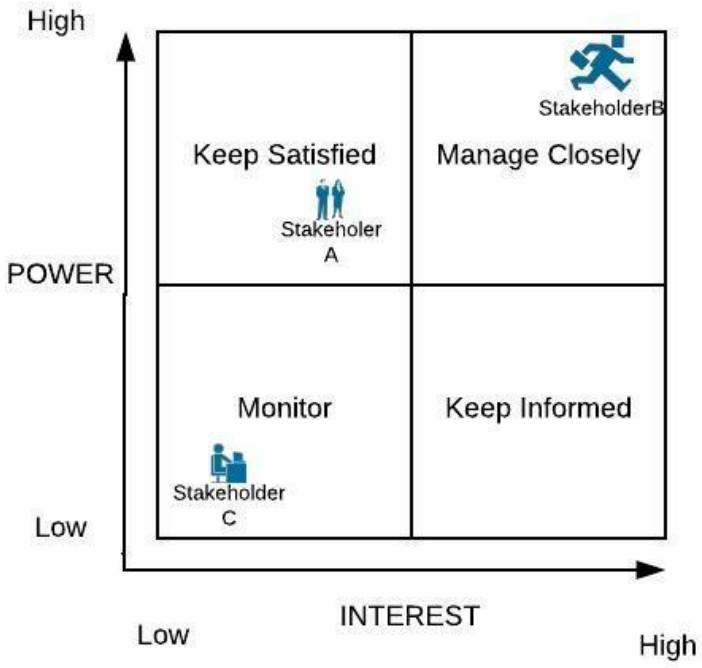

Figure 12 Power & Interest Grid

Source: (Author, 2018)

Plan Stakeholder Engagement

Plan Stakeholder Engagement is the process of developing the appropriate management strategies to effectively engage stakeholders throughout the lifecycle of the project. This process will manage stakeholder expectations by considering power, interest, impact and influence. Key benefit of this process is the creation of an actionable plan to interact effectively with stakeholders (PMI, 2017).

The Project Manager will use a Stakeholder Engagement Matrix to ensure that the appropriate level of engagement is being conducted. Each stakeholder should be

assessed based on his/her current engagement and the desired level of engagement. The letter C will indicate current engagement level and the letter D will indicate the desired engagement level. Chart 28 is a template of the Stakeholder Engagement Matrix to be filled in by the Project Manager.

PMBOK Guide 6th Edition classifies the engagement levels as follows:

Unaware - Unaware of the project and potential impacts.
Resistant- Aware of the project and potential impacts and resistant to change.
Neutral - Aware of the project yet neither supportive nor resistant.
Supportive- Aware of the project and potential impacts and supportive to change.
Leading- Aware of the project and potential impacts and actively engaging in ensuring the project is a success.

Chart 28 Stakeholder Engagement Matrix

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Stakeholder A					
Stakeholder B					
Stakeholder C					

Source: (Author, 2018)

This analytic tool allows the Project Manager to identify deficiencies between current and desired engagement, thus giving the project team the opportunity to make adjustments and improve engagement resulting in the desired level of engagement being achieved. The project team, using the identified stakeholder list and information from the stakeholder register, will assess which category, as seen

in the Chart 28, the stakeholders should be assigned to. For example, the Project Engineer may be categorized as Leading, whereas the Customers may be Supportive. Each stakeholder must be scrutinized thoroughly to most accurately gage their level of engagement within the project.

Manage Stakeholder Engagement

PMBOK Guide 6th Edition describes the Manage Stakeholder Engagement Process as the process of communicating and working with stakeholders to meet their needs and expectations, and to address issues as they occur throughout the project lifecycle. To date BWS has not implemented yet a firm stakeholder engagement plan for external stakeholders when carrying out project work. It is important that external stakeholders such as customers from rural areas are included in project discussion. Most of these rural customers have just recently been connected to water services and are not being billed for usage but only charged a flat rate fee during an adjustment period. The key benefits of this process is that it enables the project team and the larger BWS to garner the support of the stakeholders and the decrease project and change resistance thus increasing the probability of project success and support to the company.

BWS will utilize the strategies developed in both Stakeholder Management Plan and the Communications Management Plan to effectively manage the stakeholder engagement. The Communications Management Plan provides the communication methods and other relevant communication strategies that will be used throughout the stakeholder engagement process. Through observations and feedback channels the project team will determine how well stakeholder communication strategies have been received by individual stakeholders; and ascertain whether the information being communicated is being received and understood. The information gathered will be critical as it will highlight the areas of the plan that require adjustments.

The Project Management Plan can be updated when there are changes made to subsidiary plans. The management plans are not fixed; therefore, the Stakeholder Management Plan can be updated. For the Supply and Install Generator and Mechanical Electrical Upgrade Project, the stakeholder data collected and documented in the Stakeholder Analysis should be reviewed on a biweekly basis to ensure that the plan is achieving the desired expectations of the project as well as to make adjustments where necessary.

PMI (2017) states Monitor Stakeholder Engagement is “the process of monitoring project stakeholder relationships and tailoring strategies for engaging stakeholders through modification of engagement strategies and plans.” Monitor Stakeholder Engagement involves collecting information, determining the existing level of engagement and using the knowledge from the information collected to adjust strategies and approaches for effectively engaging stakeholders.

Data Analysis is one of the tools that the project manager will use to carry out monitoring of the stakeholder engagement. In the event the Project Team identifies lapses in the stakeholder engagement strategy the Project Team can carry out Root Cause Analysis to identify the problem and develop a solution. The analysis will be carried out when required and should be conducted during the Stakeholder Analysis Review. Reviews are recommended on a biweekly schedule to run parallel with already agreed upon meeting schedules. The Root Cause Analysis is an analytic tool that is used to determine the cause of the problem detected. The analysis follows the steps outlined in Figure 14 below:

Figure 13 Root Cause Analysis Process Diagram

Source: (Author, 2018)

The Root Cause Analysis acts as a tool that deeply examines the sources of a problem thus increasing the likelihood of creating an effective corrective action. This process will yield updates to existing data, strategies and plans. The Monitoring Process will result in updates to relevant subsidiary plans and stakeholder register.

CONCLUSIONS

The development of the Final Graduation Project objectives resulted in the formation of nine individual management plans for the Belize Water Services to use as it carries out the Supply and Installment of Generator and Mechanical and Electrical Upgrade Project. The general objective of this project was to create a Project Management Plan for BWS to manage the supply and installation of a functional generator with accompanying eletrical distribution systems for pump stations at the Benque Veijo Del Carmen standby facility. This was accomplished by using the tools and techniques prescribed by the Project Management Institute, as well as the avaliable organizational assets provided by BWS. The objectives were directly related to the absence of a complete project management system.

1. Nine management plans were created to address the specific objectives of the project. The management plans were developed using the Analytic, Quantitative and Qualitative research methods.
2. The Scope Management Plan outlined the WBS, WBS dictionary, Acceptance Criteria templates and specified project inclusion, exclusions and constraints.
3. The Schedule Management Plan produced tools and techniques which would be used to keep the project within the constraints of the schedule. The outputs are namely the definition of schedule tools, activity list template, predecessors list and schedule assessment template.
4. The Cost Management Plan produced the definition of the cost tools and outlined how the use of earned valued management would be integrated into developing the budget.
5. The Quality Management Plan outputs are the roles and responsibility matrix, deliverable quality checklist and the identification of how quality would be defined and tested.
6. The Resource Management Plan produced the human and physical resource lists, define the procedures of resource acquisition and specified team development activities.

7. The Communication Management Plan outline the elements and importance of communication. It also went on to provide communication requirement samples and communication strategies for the BWS project.
8. The Risk Management Plan was developed in detail. This management plan developed techniques such as risk identification procedures like the RBS; risk analysis techniques used to qualify risk; risk probability and impact estimation which is used to determine responses and how risks were managed; and risk monitoring strategy.
9. The Procurement Management Plan was developed mainly using the existing procedures and policies of BWS. BWS had well-developed bid procedures and policies in place company wide, which included the involvement of many departments outside of the project team.
10. The Stakeholder Management Plan resulted in several templates to be used to effectively manage stakeholder needs and expectations. Notably, the stakeholder engagement matrix and the stakeholder register templates were developed.

RECOMMENDATIONS

1. BWS should develop an official and permanent Project Management Office (PMO) to manage all the company's projects. The PMO would develop project management policies which would be used to guide all projects.
2. BWS should invest in a program to educate employees in the project management field so that all the staff that directly works with the project work are qualified as project management professionals
3. BWS should invest in acquiring a more power version of Microsoft Project so it can be utilized by more than one project team member.
4. BWS should hire an experienced project management professional to work with the sponsor and project manager to oversee project work.
5. BWS should place greater concerns on schedule management to execute the projects within the estimated time and put in place penalties when contractors do not perform work within the agreed upon schedule.

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APPENDICES

Appendix 1: FGP Charter

PROJECT CHARTER Formalizes the project start and confers the project manager with the authority to assign company resources to the project activities. Benefits: it provides a clear start and well defined project boundaries.	
Date	Project Name:
May 15, 2018	Project Management Plan for Supply and Install of Generator and Mechanical and Electrical Upgrade
Knowledge Areas / Processes	Applicacion Area (Sector / Activity)
Knowledge areas: Project Integration Management, Scope Management, Schedule Management, Cost Management, Quality Management, Resource Management, Communication Management, Risk Management, Procurement Management and Stakeholder Management Process groups: Initiate, Plan, Execute, Monitor and Control and Closing	Construction: Utilitiy upgrade
Start date	Finish date
May 15, 2018	June 17, 2018
Project Objectives (general and specific)	
General objective: Create a Project Management Plan to manage the installation and commissioning of fully functional generator with accompanying eletrical distribution systems for pump stations Specific objectives: 1 To Create a Scope Management Plan in order to ensure that the project includes all the work requried to complete the project. 2 To Create a Schedule Management Plan in order to establish the policies, procedures and documentation for planning, developing, managing, exxecuting and controlling the project schedule. 3 To Create a Cost Managemement Plan in order to establish the policies, procedures and documentation for planning, developing, managing, exxecuting and controlling the project cost. 4 To Create a Quality Management Plan in order to identify the quality requirements for the project. 5 To Create a Resource Managemen Plan that will define the resources that are required to complete the project. 6 To Create a Communication Management Plan to develop the appropriate approach and plan for the projecct communications based on stakeholer information needs, requirements and availabile organizational assests. 7 To Create Risk Management Plan in order to develop options and actions to enhance oppurtunitiess and to reduce threats to project objectives. 8 To Create a Procurement Management Plan in order to document project procurement decisions, specifying the approach and identifying potential sellers. 9 To Create a Stakeholder Management Plan in order to indentify the people or groups or organizations that impact or be impacted by a decision, activity, involvement, influenece and potential impact on project success.	
Project purpose or justification (merit and expected results)	
The purpose of the this project is to create a Project Management Plan which can be used to execute the project the Supply and Install of Generator and Mechanical Electrical Upgrade Project for the Belize Water Services Limited (BWS). This management plan will provide the Belize Water Services Limited with the required action plans in order to successfully	

complete the project by achieving the objectives of supplying to its customers theuninterrupted supply of electricity the pumps. This will ensure the continuous supply of water; particularly in times of power outages and electrical faults.

Description of Product or Service to be generated by the Project – Project final deliverables

The project will yield a Project Management Plan and all of the subsidiary plans that are products of the different knowledge areas

Assumptions

The primary assumption associated with the FGP is that Project Sponsor, who is the lead engineer on the Install of Generator and Mechanical & Electrical Upgrade Project, will continue to provide the needed information

Constraints

Scope: Early scope definition limits the ability to make needed adjustments to the scope as new information becomes available.
Schedule: Schedule is not flexible and the deadline for submission must be adhere to.
Cost:
Resources: Managing resources, primarily information sources may not be possible
Quality: Insufficient information on the FGP topic can lead to deminished quality of the product by way of not being able to identify the best subsidary plans and tools that are best applicable.
Communicaton: Interaction between student and tutor may be delayed due to parties residing in different countries. As well as misinterpretation of written explanations which will require time to align.

Preliminary risks

Due to the uncertainty of continuous availability of information from the project sponsor and only having one source, it threatens to impact the quality of the project as well as the overall security of the project. This could impact parts of the project falling short due to insufficient knowledge or areas not being completed.

Budget

Project is estimated to cost $227,000Belize Dollars.

Milestones and dates

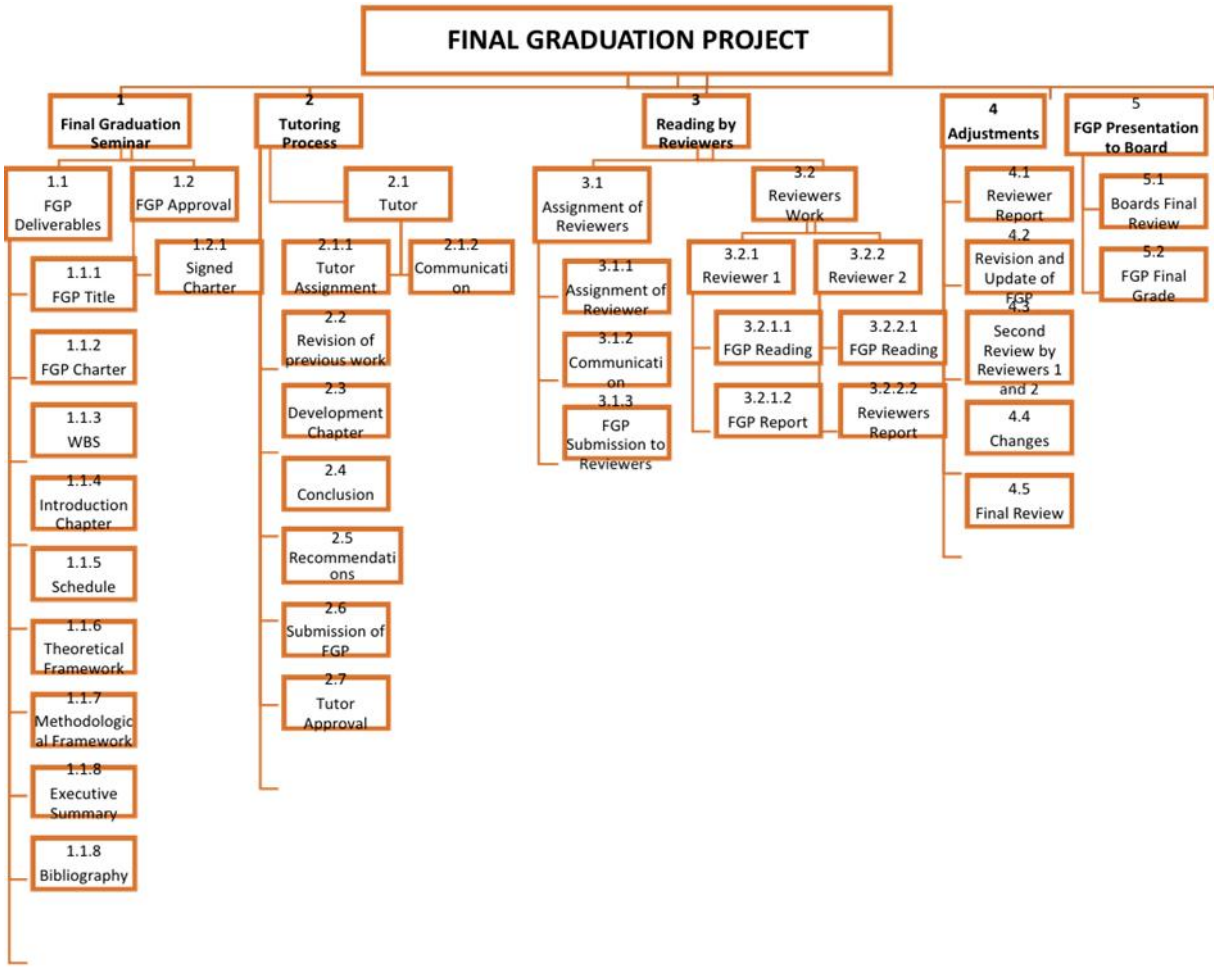
Milestone	Start date	End date
Graduation Seminar	May 14, 2018	June 17, 2018
Project Charter	May 14, 2018	May 20, 2018
WBS	May 14, 2018	May 20, 2018
Introduction Chapter	May 21, 2018	May 27, 2018
FGP Schedule	May 21, 2018	May 27, 2018
Theoretical Framework Chapter	May 28, 2018	June 4, 2018
Methodological Framework	June 5, 2018	June 10, 2018
Executive Summary	June 11, 2018	June 17, 2018
Bibliography	June 11, 2018	June 17, 2018
Approval	June 17, 2018	June 24, 2018

Relevant historical information

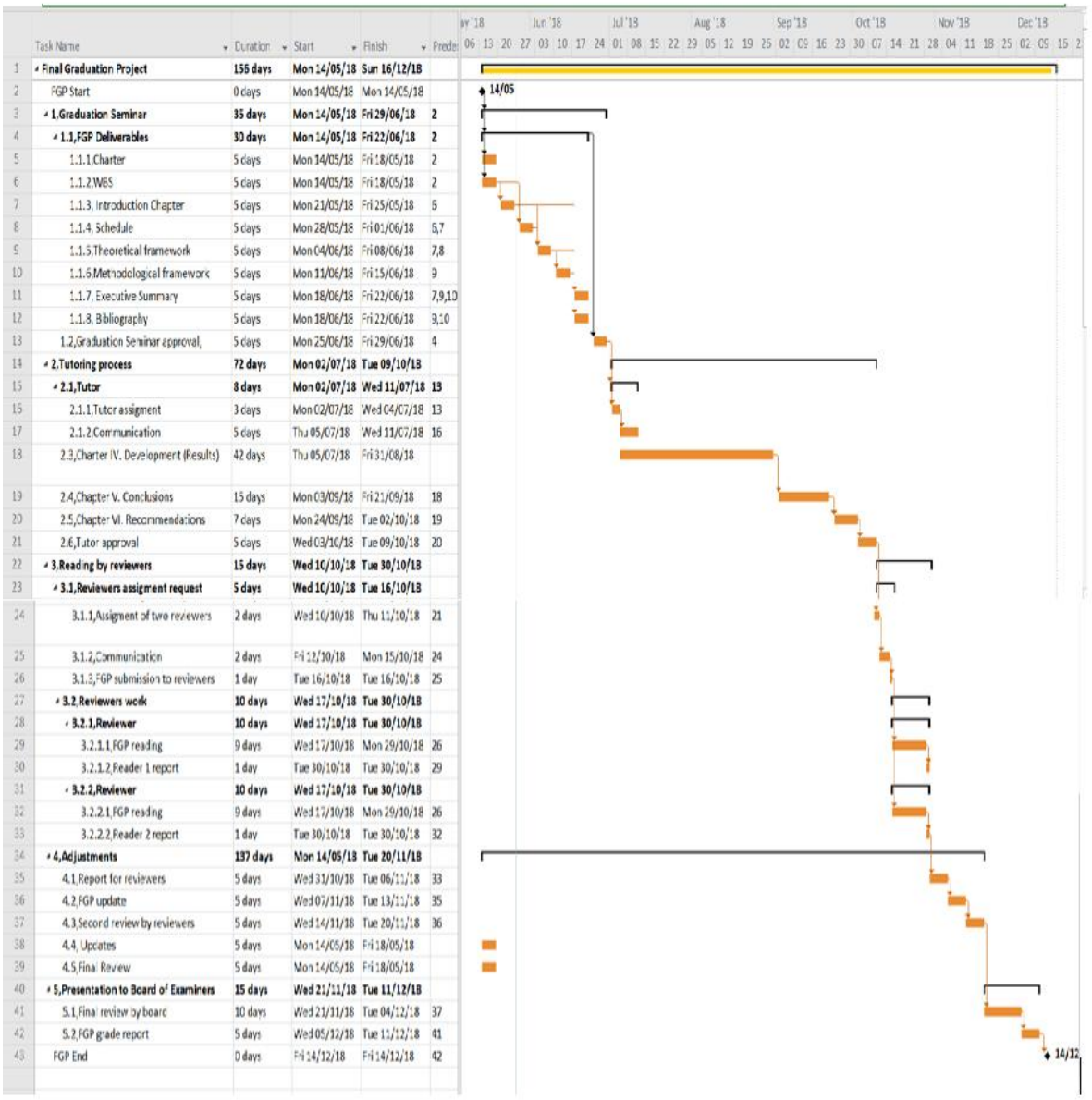
The Belize Water Sevices Limited is the country's only water and sewage utility, severing all the municipalities of the country as well as 35 villages. The company serves over 57,200 customers or approximately 250,000 customers, with a monthly average water demand of over 208 million US gallons. The Belize Water Services Limited has established a capital expenditure programme amied at providing cost efficient and reliable water and wastewater services. The programme includes: a number of water network exxpansions projects, several prjects to upgrade or replace aged infrastructure, refurbishment and expansion of water treatment plants and storage tanks as well as construction of new water sources.
Stakeholders
Direct stakeholders: Genesia Tucker Course Facillitator The University Indirect stakeholders: Classmates Employers

Project Manager: Genesia Tucker	Signature: G Tucker
Authorized by :	Signature

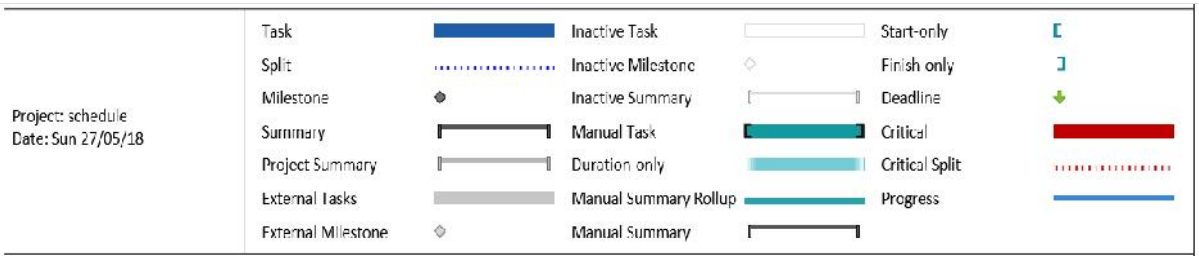
Appendix 2: FGP WBS



Appendix 3: FGP Schedule



	Task Name	Duration	Start	Finish	Predec
1	**Final Graduation Project**	**155 days**	**Mon 14/05/18**	**Sun 16/12/18**	
2	FGP Start	0 days	Mon 14/05/18	Mon 14/05/18	
3	**1.Graduation Seminar**	**35 days**	**Mon 14/05/18**	**Fri 29/06/18**	**2**
4	**1.1,FGP Deliverables**	**30 days**	**Mon 14/05/18**	**Fri 22/06/18**	**2**
5	1.1.1,Charter	5 days	Mon 14/05/18	Fri 18/05/18	2
6	1.1.2,WBS	5 days	Mon 14/05/18	Fri 18/05/18	2
7	1.1.3, Introduction Chapter	5 days	Mon 21/05/18	Fri 25/05/18	5
8	1.1.4, Schedule	5 days	Mon 28/05/18	Fri 01/06/18	6,7
9	1.1.5,Theoretical framework	5 days	Mon 04/06/18	Fri 08/06/18	7,8
10	1.1.6,Methodological framework	5 days	Mon 11/06/18	Fri 15/06/18	9
11	1.1.7, Executive Summary	5 days	Mon 18/06/18	Fri 22/06/18	7,9,10
12	1.1.8, Bibliography	5 days	Mon 18/06/18	Fri 22/06/18	9,10
13	1.2,Graduation Seminar approval,	5 days	Mon 25/06/18	Fri 29/06/18	4
14	**2.Tutoring process**	**72 days**	**Mon 02/07/18**	**Tue 09/10/18**	
15	**2.1,Tutor**	**8 days**	**Mon 02/07/18**	**Wed 11/07/18**	**13**
16	2.1.1,Tutor assigment	3 days	Mon 02/07/18	Wed 04/07/18	13
17	2.1.2,Communication	5 days	Thu 05/07/18	Wed 11/07/18	16
18	2.3,Charter IV. Development (Results)	42 days	Thu 05/07/18	Fri 31/08/18	
19	2.4,Chapter V. Conclusions	15 days	Mon 03/09/18	Fri 21/09/18	18
20	2.5,Chapter VI. Recommendations	7 days	Mon 24/09/18	Tue 02/10/18	19
21	2.6,Tutor approval	5 days	Wed 03/10/18	Tue 09/10/18	20
22	**3.Reading by reviewers**	**15 days**	**Wed 10/10/18**	**Tue 30/10/18**	
23	**3.1,Reviewers assigment request**	**5 days**	**Wed 10/10/18**	**Tue 16/10/18**	
24	3.1.1,Assigment of two reviewers	2 days	Wed 10/10/18	Thu 11/10/18	21
25	3.1.2,Communication	2 days	Fri 12/10/18	Mon 15/10/18	24
26	3.1.3,FGP submission to reviewers	1 day	Tue 16/10/18	Tue 16/10/18	25
27	**3.2,Reviewers work**	**10 days**	**Wed 17/10/18**	**Tue 30/10/18**	
28	**3.2.1,Reviewer**	**10 days**	**Wed 17/10/18**	**Tue 30/10/18**	
29	3.2.1.1,FGP reading	9 days	Wed 17/10/18	Mon 29/10/18	26
30	3.2.1.2,Reader 1 report	1 day	Tue 30/10/18	Tue 30/10/18	29
31	**3.2.2,Reviewer**	**10 days**	**Wed 17/10/18**	**Tue 30/10/18**	
32	3.2.2.1,FGP reading	9 days	Wed 17/10/18	Mon 29/10/18	26
33	3.2.2.2,Reader 2 report	1 day	Tue 30/10/18	Tue 30/10/18	32
34	**4,Adjustments**	**137 days**	**Mon 14/05/18**	**Tue 20/11/18**	
35	4.1,Report for reviewers	5 days	Wed 31/10/18	Tue 06/11/18	33
36	4.2,FGP update	5 days	Wed 07/11/18	Tue 13/11/18	35
37	4.3,Second review by reviewers	5 days	Wed 14/11/18	Tue 20/11/18	36
38	4.4, Updates	5 days	Mon 14/05/18	Fri 18/05/18	
39	4.5,Final Review	5 days	Mon 14/05/18	Fri 18/05/18	
40	**5,Presentation to Board of Examiners**	**15 days**	**Wed 21/11/18**	**Tue 11/12/18**	
41	5.1,Final review by board	10 days	Wed 21/11/18	Tue 04/12/18	37
42	5.2,FGP grade report	5 days	Wed 05/12/18	Tue 11/12/18	41
43	FGP End	0 days	Fri 14/12/18	Fri 14/12/18	42



Appendix 4: Change Request Form Template

[Project Name] Change Request

Change name	[short description]		
Date Submitted	[mm/dd/yy]	**Change Request Number**	[nnnn]
Requested by	[Name of person requesting change]		
Submitted by	[Name of person writing this request]		

Detailed Description of Change

[description]

Impact Analysis

Schedule	
Cost	
Related affects to other projects or parts of this project	

Decision and Rationale

[description]

Approval:	[signature]
Approved by:	[name]
Approval date:	[mm/dd/yy]

Source: Adapted from: http://www.versatilecompany.com/downloadable-forms.aspx

Appendix 5: Issue Log Template

[Project Name] Issues Log

Last updated [mm/dd/yy]

Project Manager: [Name]

Issue ID	WBS	Date Found	Assigned	Description	Status	Close Out Date

Description of fields:

Issue Id: A unique identifier

WBS: WBS number of the task(s) related to this risk

Date found: Date issue became known. mm/dd/yy

Assigned: Person who is assigned to resolve this issue

Description: What is the problem or what action needs to be taken?

Status: On-going log of changes to issue, in order from most recent to oldest. Format: mm/dd/yy – action/update

Close out date: When did the issue get resolved?

Source: Adapted from: http://www.versatilecompany.com/downloadable-forms.aspx

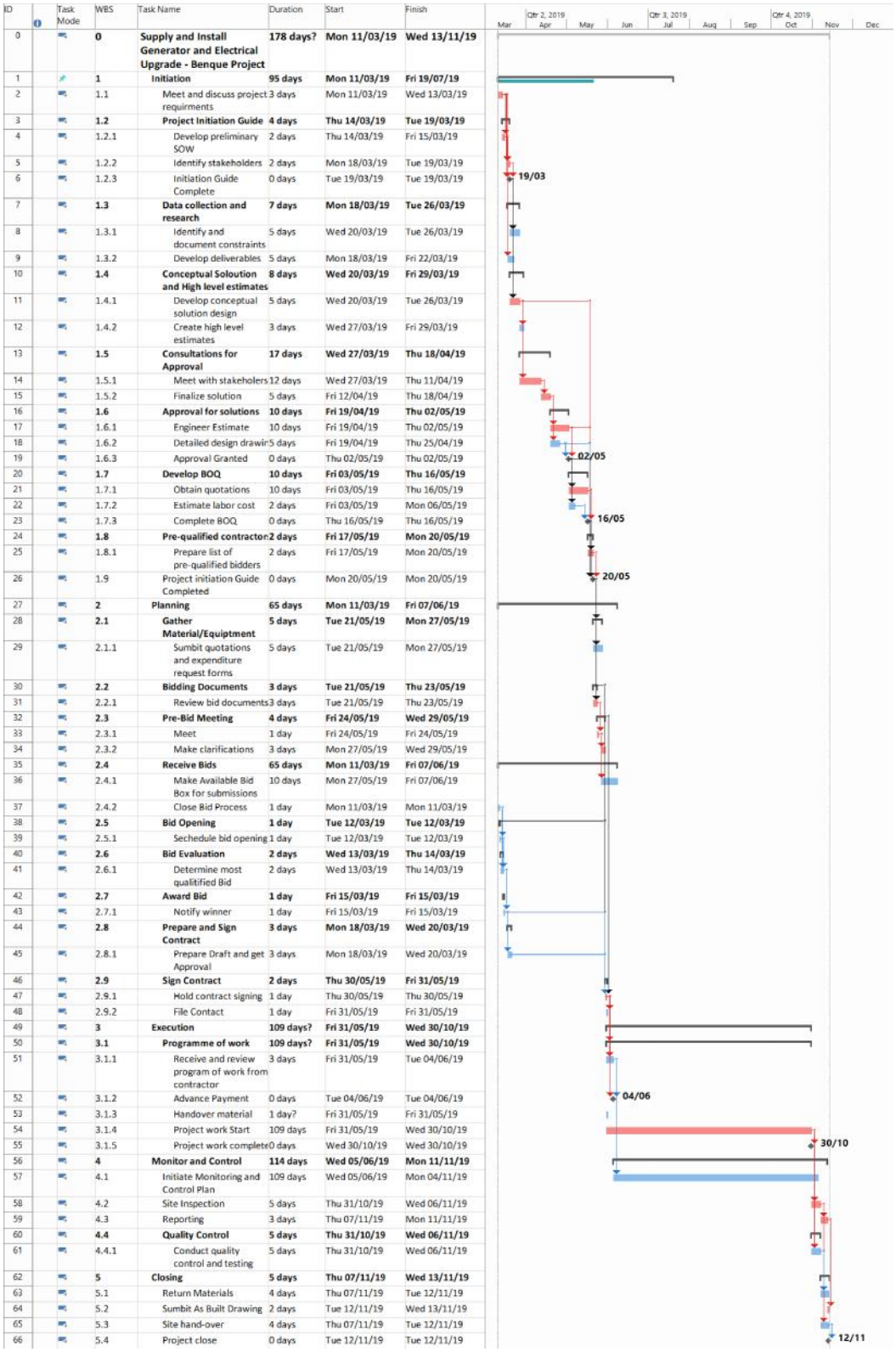
Appendix 6: Team Assessment Template

Team Member: _____
Project Name: _____
Project Manager: _____
Evaluation Date: _____

Respond with a grade from 1 to 5 to the following statements about the Team Member: (1 = low, 5 = high)	1	2	3	4	5	Comments
Displayed a commitment to the project.						
Clearly communicated issues and took action as necessary. Was proactive and results oriented.						
Met due date commitment or provided the best possible alternative if the original due date could not be met for their work.						
Communicated within the team environment appropriately.						
Maintained strong leadership at times and support of the project team; set an example of flexibility.						
Effectively utilized project tools when applicable, i.e., status reports, project schedule, project repository.						
Communicated any risks to the project objectives or milestone appropriately.						
Used effective escalation of changes in the project.						
Conducted timely project meetings and conference calls with team members; had control of meetings.						
Provided feedback and suggestions for improvement during the project.						
Performed in a courteous and professional manner.						
Added value to the project.						

Had good knowledge of products and services involved in the project.						
Showed sound and appropriate decision-making during the project.						

Appendix 7: Project Schedule for Supply and Install Generator and Electrical Upgrade – Benque Project (author, 2018)



ID	Task Mode	WBS	Task Name	Duration	Start	Finish
0		0	**Supply and Install Generator and Electrical Upgrade - Benque Project**	**178 days?**	**Mon 11/03/19**	**Wed 13/11/19**
1		1	**Initiation**	**95 days**	**Mon 11/03/19**	**Fri 19/07/19**
2		1.1	Meet and discuss project requirments	3 days	Mon 11/03/19	Wed 13/03/19
3		1.2	**Project Initiation Guide**	**4 days**	**Thu 14/03/19**	**Tue 19/03/19**
4		1.2.1	Develop preliminary SOW	2 days	Thu 14/03/19	Fri 15/03/19
5		1.2.2	Identify stakeholders	2 days	Mon 18/03/19	Tue 19/03/19
6		1.2.3	Initiation Guide Complete	0 days	Tue 19/03/19	Tue 19/03/19
7		1.3	**Data collection and research**	**7 days**	**Mon 18/03/19**	**Tue 26/03/19**
8		1.3.1	Identify and document constraints	5 days	Wed 20/03/19	Tue 26/03/19
9		1.3.2	Develop deliverables	5 days	Mon 18/03/19	Fri 22/03/19
10		1.4	**Conceptual Soloution and High level estimates**	**8 days**	**Wed 20/03/19**	**Fri 29/03/19**
11		1.4.1	Develop conceptual solution design	5 days	Wed 20/03/19	Tue 26/03/19
12		1.4.2	Create high level estimates	3 days	Wed 27/03/19	Fri 29/03/19
13		1.5	**Consultations for Approval**	**17 days**	**Wed 27/03/19**	**Thu 18/04/19**
14		1.5.1	Meet with stakeholders	12 days	Wed 27/03/19	Thu 11/04/19
15		1.5.2	Finalize solution	5 days	Fri 12/04/19	Thu 18/04/19
16		1.6	**Approval for solutions**	**10 days**	**Fri 19/04/19**	**Thu 02/05/19**
17		1.6.1	Engineer Estimate	10 days	Fri 19/04/19	Thu 02/05/19
18		1.6.2	Detailed design drawir	5 days	Fri 19/04/19	Thu 25/04/19
19		1.6.3	Approval Granted	0 days	Thu 02/05/19	Thu 02/05/19
20		1.7	**Develop BOQ**	**10 days**	**Fri 03/05/19**	**Thu 16/05/19**
21		1.7.1	Obtain quotations	10 days	Fri 03/05/19	Thu 16/05/19
22		1.7.2	Estimate labor cost	2 days	Fri 03/05/19	Mon 06/05/19
23		1.7.3	Complete BOQ	0 days	Thu 16/05/19	Thu 16/05/19
24		1.8	**Pre-qualified contractor**	**2 days**	**Fri 17/05/19**	**Mon 20/05/19**
25		1.8.1	Prepare list of pre-qualified bidders	2 days	Fri 17/05/19	Mon 20/05/19
26		1.9	Project initiation Guide Completed	0 days	Mon 20/05/19	Mon 20/05/19
27		2	**Planning**	**65 days**	**Mon 11/03/19**	**Fri 07/06/19**
28		2.1	**Gather Material/Equiptment**	**5 days**	**Tue 21/05/19**	**Mon 27/05/19**
29		2.1.1	Sumbit quotations and expenditure request forms	5 days	Tue 21/05/19	Mon 27/05/19
30		2.2	**Bidding Documents**	**3 days**	**Tue 21/05/19**	**Thu 23/05/19**
31		2.2.1	Review bid documents	3 days	Tue 21/05/19	Thu 23/05/19
32		2.3	**Pre-Bid Meeting**	**4 days**	**Fri 24/05/19**	**Wed 29/05/19**
33		2.3.1	Meet	1 day	Fri 24/05/19	Fri 24/05/19
34		2.3.2	Make clarifications	3 days	Mon 27/05/19	Wed 29/05/19
35		2.4	**Receive Bids**	**65 days**	**Mon 11/03/19**	**Fri 07/06/19**
36		2.4.1	Make Available Bid Box for submissions	10 days	Mon 27/05/19	Fri 07/06/19
37		2.4.2	Close Bid Process	1 day	Mon 11/03/19	Mon 11/03/19
38		2.5	**Bid Opening**	**1 day**	**Tue 12/03/19**	**Tue 12/03/19**
39		2.5.1	Sechedule bid opening	1 day	Tue 12/03/19	Tue 12/03/19
40		2.6	**Bid Evaluation**	**2 days**	**Wed 13/03/19**	**Thu 14/03/19**
41		2.6.1	Determine most qualitified Bid	2 days	Wed 13/03/19	Thu 14/03/19
42		2.7	**Award Bid**	**1 day**	**Fri 15/03/19**	**Fri 15/03/19**
43		2.7.1	Notify winner	1 day	Fri 15/03/19	Fri 15/03/19
44		2.8	**Prepare and Sign Contract**	**3 days**	**Mon 18/03/19**	**Wed 20/03/19**
45		2.8.1	Prepare Draft and get Approval	3 days	Mon 18/03/19	Wed 20/03/19
46		2.9	**Sign Contract**	**2 days**	**Thu 30/05/19**	**Fri 31/05/19**
47		2.9.1	Hold contract signing	1 day	Thu 30/05/19	Thu 30/05/19
48		2.9.2	File Contact	1 day	Fri 31/05/19	Fri 31/05/19
49		3	**Execution**	**109 days?**	**Fri 31/05/19**	**Wed 30/10/19**
50		3.1	**Programme of work**	**109 days?**	**Fri 31/05/19**	**Wed 30/10/19**
51		3.1.1	Receive and review program of work from contractor	3 days	Fri 31/05/19	Tue 04/06/19
52		3.1.2	Advance Payment	0 days	Tue 04/06/19	Tue 04/06/19
53		3.1.3	Handover material	1 day?	Fri 31/05/19	Fri 31/05/19
54		3.1.4	Project work Start	109 days	Fri 31/05/19	Wed 30/10/19
55		3.1.5	Project work complete	0 days	Wed 30/10/19	Wed 30/10/19
56		4	**Monitor and Control**	**114 days**	**Wed 05/06/19**	**Mon 11/11/19**
57		4.1	Initiate Monitoring and Control Plan	109 days	Wed 05/06/19	Mon 04/11/19
58		4.2	Site Inspection	5 days	Thu 31/10/19	Wed 06/11/19
59		4.3	Reporting	3 days	Thu 07/11/19	Mon 11/11/19
60		4.4	**Quality Control**	**5 days**	**Thu 31/10/19**	**Wed 06/11/19**
61		4.4.1	Conduct quality control and testing	5 days	Thu 31/10/19	Wed 06/11/19
62		5	**Closing**	**5 days**	**Thu 07/11/19**	**Wed 13/11/19**
63		5.1	Return Materials	4 days	Thu 07/11/19	Tue 12/11/19
64		5.2	Sumbit As Built Drawing	2 days	Tue 12/11/19	Wed 13/11/19
65		5.3	Site hand-over	4 days	Thu 07/11/19	Tue 12/11/19
66		5.4	Project close	0 days	Tue 12/11/19	Tue 12/11/19

Appendix 8: Project Cost Estimate for Supply and Install Generator and Electrical Upgrade – Benque Project (Source: BWS Project Engineer)

High Level Estimate

EQUIPMENT/MATERIAL

Document	Description	Supplier	Est. Qty.	Unit	Rate (USD/Unit)	Rate (USD/Unit)	TOTAL (USD)	BZD (USD*2.02)
	BEL Power Upgrade							
	225kVA 480/277V Padmount Transformer Installation (480V Upgrade)	Belize Electricity Limited						$ 25,000.00
							$ -	**$ 25,000.00**
	Generator							
	80kVA, 1800 rpm, 480V, 3Ph, Wye Generator	Armstrong Power Systems						$ 90,234.37
							$ -	**$ 90,234.37**
	Motors							
984	15HP, 230/460V, 3Phase, 1.15 S.F. Submersible Motor	Pumps & Motors of Belize						$ 4,635.00
984	10HP, 230/460V, 3Phase, 1.15 S.F. Submersible Motor	Pumps & Motors of Belize						$ 4,299.00
							$ -	**$ 8,934.00**
	Electrical Distribution System - 480V							
					Agrimech	IES		
	Main Breaker Disconnect - 200A, 600V, 10KAIC, 100% Rated, LSIG Trip Unit, NEMA 1 Enclosure		1	EA		$ 896.60		
	Surge Protective Device - 480/277V, 3 Phase, Wye, 180kA per Phase, Diagnostic Lights		2	EA		$ 3,013.62		
	Surge Protective Device - 208/120V, 3 Phase, Wye, 120kA per Phase, Diagnostic Lights		1	EA		$ 1,035.93		
	Automatic Transfer Switch - 200A, 480V, 3Phase, 10KAIC, Neutral Bar, All Standard Metering, Adjustable Voltage & Frequency Pick-Up/Drop-Out, Adjustable Time Delays, Closed Transition System		1	EA		$ 1,774.00		
	Main Distribution Panel - 480/277V, 3Phase, 4W, 10KAIC, 200A Cu Bus, 200A 100% Rated Main Breaker, 24Cts, NEMA 1 Enclosure		1	EA				
	Breaker - 60A, 3Pole, 480/277V, LSIG Trip Unit		2	EA				
	Breaker - 50A, 3Pole, 480/277V, LSIG Trip Unit		1	EA				
	Breaker - 30A, 3 Pole, 480/277V, LSIG Trip Unit		1	EA		$ 1,863.89		
	Breaker - 60A, 3 pole, 480/277V		1	EA				
	Breaker - 40A, 3Pole, 480/277V		1	EA				
	Breaker - 30A, 3 Pole, 480/277V		1	EA				
	Step-Down Dry Transformer, 30kVA, 480V:208/120V Y, Type 1, Aluminum		1	EA		$ 1,400.99		
	Safety Disconnect Switch - 60A, 3P, 10KAIC, 600V, NEMA 3R		2	EA		$ 276.50		
	Safety Disconnect Switch - 50A, 3P, 10KAIC, 600V, NEMA 3R -> 30A		1	EA		$ 81.37		
	Safety Disconnect Switch - 30A, 3P, 10KAIC, 600V, NEMA 3R		1	EA		$ 78.33		
	Lighting Panel - 208/120V, 3Phase, 4W, 10KAIC, 225A Cu Bus, 100A 100% Rated Main Breaker, 42Ct, NEMA 1 Enclosure		1	EA				
	Breaker - 15A, 1Pole, 208/120V		13	EA				
	Breaker - 30A, 1Pole, 208/120V		1	EA				
	Breaker - 30A, 2Pole, 208/120V		2	EA		$ 517.21		
	Breaker - 50A, 2Pole, 208/120V		1	EA				
	Breaker - 60A, 2Pole, 208/120V		2	EA				
	Erico Copper Grounding Bus Bar - EGBA18212GG		1	EA				
	SHIPPING & HANDLING		1	LS				
					$ 13,734.00	**$ 10,938.44**	**$ 10,938.44**	**$ 22,095.65**
	MCC Equipment							
1345-10 BWS	ABB Voltage Monitor WVM Series 480V 3 Phase (WVM911RN)	Agrimech	1	EA	$ 384.50		$ 384.50	$ 776.69
1345-10 BWS	Contactor 20HP @460V	Agrimech	2	EA	$ 788.50		$ 1,577.00	$ 3,185.54
1345-10 BWS	3Ph 60A Terminal Block	Agrimech	2	EA	$ 19.75		$ 39.50	$ 79.79
1345-10 BWS	Grounding Bar Kit W/11 Terminal Positions #ECLX071M	Agrimech	1	EA	$ 10.00		$ 10.00	$ 20.20
1345-10 BWS	Hoffman AFLT86 Filter	Agrimech	1	EA	$ 41.25		$ 41.25	$ 83.33
1345-10 BWS	Hoffman AVK86SS6 Louvers	Agrimech	1	EA	$ 163.00		$ 163.00	$ 329.26
1345-10 BWS	Cooper Storm Trapper Metal Encased Distribution (480V) - Surge Arrester	Agrimech	2	EA	$ 99.50		$ 199.00	$ 401.98
1345-10 BWS	120V Time Relay Coil DILET ETR4-11-A	Agrimech	2	EA	$ 117.75		$ 235.50	$ 475.71
1345-10 BWS	120V Relay Coil DILER-22 (120)	Agrimech	2	EA	$ 60.25		$ 120.50	$ 243.41
1345-10 BWS	600V Circuit Breaker 40A-63A #NZMB2-A63-BT-NA	Agrimech	2	EA	$ 519.75		$ 1,039.50	$ 2,099.79
1345-10 BWS	Inland Freight	Agrimech	1	LS	$ 165.25		$ 165.25	$ 333.81
							$ 3,975.00	**$ 8,029.50**
N180AD0327	GS4 20HP AC DRIVE 460VAC 3 PHASE - GS4-4020	Automation International	2	EA	$ 1,118.00		$ 2,236.00	$ 4,516.72
N180AD0327	LINE REACTOR 460VAC 20HP 3PH DRIVE INPUT OR OUTPUT, 3% IMPEDANCE - LR-4020	Automation International	2	EA	$ 135.00		$ 270.00	$ 545.40
N180AD0327	EATON MINITATURE CIRCUIT BREAKER, 15A, 277VAC/48VDC, 1POLE, C CURVE, 14KA SCCR, 35MM DIN RAIL MOUNT	Automation International	2	EA	$ 18.50		$ 37.00	$ 74.74
N180AD0327	EATON MINITATURE CIRCUIT BREAKER, 2A, 277VAC/48VDC, 1POLE, C CURVE, 10KA SCCR, 35MM DIN RAIL MOUNT	Automation International	2	EA	$ 18.50		$ 37.00	$ 74.74
N180AD0327	STEGO SETPOINT THERMOSTAT, NORMALLY OPEN (CLOSE ON RISE), 32 TO 140F SETPOINT, 35MM DIN RAIL MOUNT	Automation International	1	EA	$ 15.25		$ 15.25	$ 30.81
N180AD0327	Hubbell-Wiegmann enclosure, NEMA 3R/4/12, 72 x 36 x 24in (HxWxD) - WRD723624FS4	Automation International	1	EA	$ 1,086.00		$ 1,086.00	$ 2,193.72
N180AD0327	Hubbell-Wiegmann subpanel, 69 x 33in, 12 gauge carbon steel, white, polyester powder coat finish - NP7236	Automation International	1	EA	$ 245.00		$ 245.00	$ 494.90
N180AD0327	Stego Filter Fan Plus FPO enclosure fan assembly, exhaust, with air flaps, 11.46 x 11.46in enclosure cutout, NEMA 12, 115 VAC operating voltage, 414 CFM, light gray, (4) 6-position ratchet lever mount, indoor use only - 018849-00	Automation International	1	EA	$ 223.00		$ 223.00	$ 450.46
N180AD0327	SHIPPING & HANDLING	Automation International	1	LS	$ 644.93		$ 644.93	$ 1,302.76
							$ 4,794.18	**$ 9,684.24**
							MATERIAL/EQUIPMENT TOTALS	**$ 163,977.76**

LABOUR

ManPower	TASK	Qty (ManPower)	Qty (Days)	Hrs/Day	Total Hrs		Hrly Rate	Total
	Contractor							$ 62,000.00
	BWS Well Motor Replacement							$ 1,000.00
							LABOUR TOTAL	**$ 63,000.00**
							PROJECT ESTIMATED TOTAL	**$ 226,977.76**

Appendix 9: Risk Metrics/Risk Register Template

Prepared By:							
Date:							
Risk Number	**Risk Event Statement**	**Risk Score This Time**	**Risk Score Last Time**	**Weeks on Risk Status Report**	**Status of Response** N / P / PE / EE	**Responsible**	**Description of Response Activities**
Provide a unique identifier for risk	A risk event statement states (i) what might happen in the future and (ii) its possible impact on the project. "Weather" is not a risk event statement. "Bad weather may delay the project" is a risk event statement.	Taken from updated Risk Analysis Worksheet	Taken from previous Risk Status Report	Enter the date the risk (not the entire log) was updated	Enter here N (No Plan); P (Plan but not enacted); PE (Plan enacted but effectiveness not yet known); EE (Plan enacted and effective)	Enter name or title of team member responsible for risk	List, by date, all actions taken to respond to the risk. This does not include assessing the risk
Example R 1	Hurricane threat	12	20		PE	Project Manager	Aquire team to secure all material and equiptment, move to secure location where possible.
R 1							
R 2							
R 3							

Source: (MDPS, 2003)

Appendix 10: Philological Review

13th November 2018

TO: University for International Cooperation
San Jose, Costa Rica

To Whom It May Concern

RE: Philological review of Final Graduation Project written by Ms. Genesia Tucker

I hereby declare that the Final Graduation Project entitled

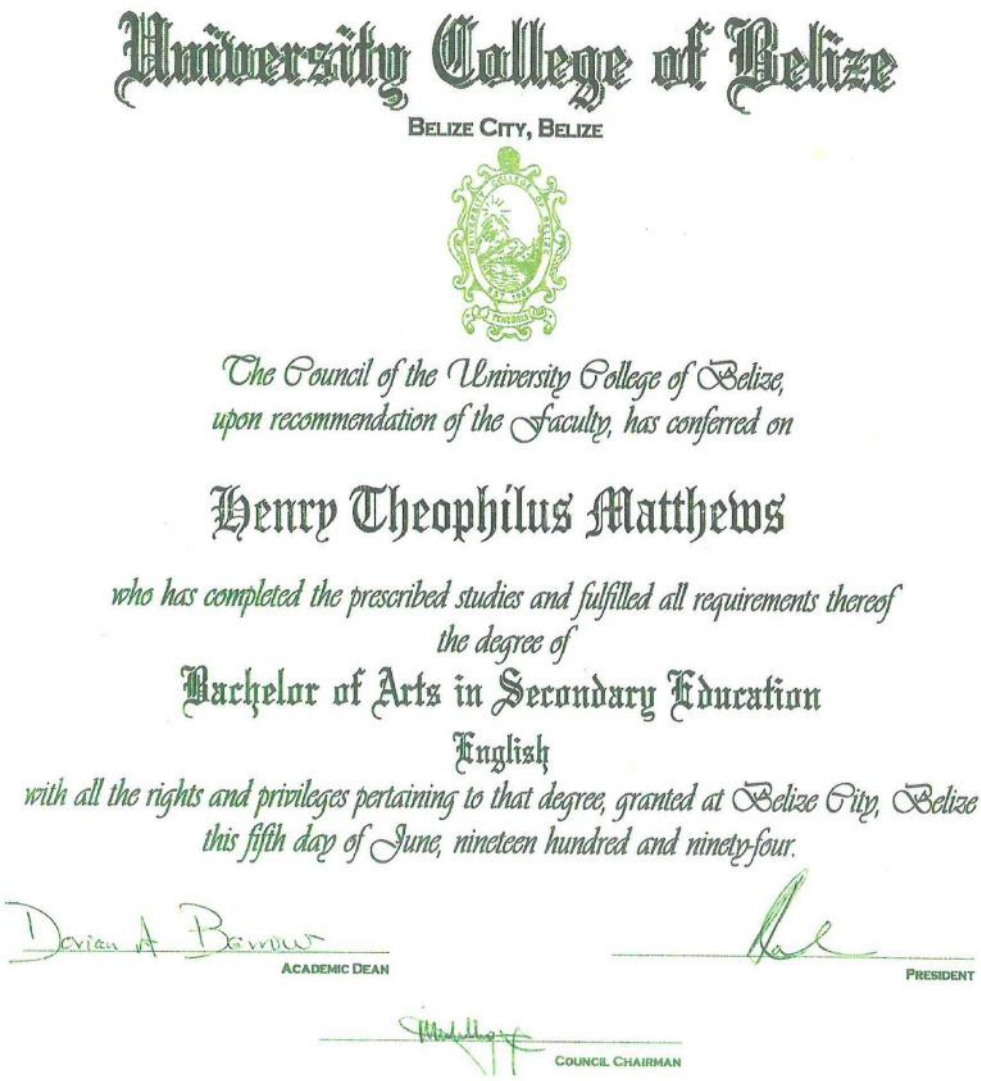
Project Management Plan Development for Supply and Install Generator and Mechanical and Electrical Upgrade for Belize Water Services Limited

has been reviewed and corrected and meets requirements of a Master's degree level.

Yours sincerely,

Mr. Henry Matthews, M.Ed. in Secondary Education; B.Ed. in English Education
+5016334943
henry,matthews.wescol@gmail.com

Appendix 11:



University College of Belize

BELIZE CITY, BELIZE

The Council of the University College of Belize,
upon recommendation of the Faculty, has conferred on

Henry Theophilus Matthews

who has completed the prescribed studies and fulfilled all requirements thereof
the degree of

Bachelor of Arts in Secondary Education

English

with all the rights and privileges pertaining to that degree, granted at Belize City, Belize
this fifth day of June, nineteen hundred and ninety-four.

ACADEMIC DEAN

PRESIDENT

COUNCIL CHAIRMAN